Theoretical and psychometric specificity of self-regulation for physical activity: Validating measures of self-regulation

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ABSTRACT

Physical activity (PA) has been shown to be an important component in preventing a number of negative health outcomes and in improving cardio respiratory fitness. However, there is little consensus as to what mediates the relationship between PA interventions and PA behaviors. Numerous studies have identified self-regulation as a proximal mediator of PA interventions, but there appears to be little consensus as to what constitutes self-regulation and how it should be measured. The current study explores the theoretical underpinnings of self-regulation from several different theories and identifies several measures related to those theories. Overlapping factors are identified by combining the measures and conducting exploratory and confirmatory factor analyses in order to understand the components of self-regulation. The results of the factor analyses revealed a seven-factor model consisting of 96 items. The factors from the final model included Self-Regulation Self-Efficacy, Negative Affect, Goal Setting/Goal Planning, Goal Communications, Goal Setting/Outcome Expectancy, Self-Monitoring, and Goal Planning. Analyses reveal that Goal Setting/Goal Planning and Goal Setting/Outcome Expectancy significantly predicted PA behaviors. How these factors relate to the theories of self-regulation and how they relate to the original measures are discussed; however several factors derived from this study contained several theoretically distinct constructs which made interpretation of these factors difficult. Future directions for identifying and developing factors of self-regulation are discussed and special consideration is given to the process of self-regulation.

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Introduction

Several health agencies, including the Surgeon General, the American Heart Association (AHA), and the American College of Sports Medicine (ACSM), have indicated that regular moderate to vigorous physical activity (PA) can prevent and treat numerous diseases including colon cancer, diabetes, hypertension, and coronary heart diseases (Cardinal, 1999; Chodzko-Zajko et al., 2009; Kaplan, Strawbridge, Cohen, & Hungerford, 1996; Kushi et al., 1997; Lee, Blair, & Jackson, 1999; Nelson et al., 2007; Paffenbarger et al., 1993; Sherman, D'Agostino, Cobb, & Kannel, 1994; U.S. Department of Health and Human Services [USDHHS], 1996; Wei et al., 1999). In 2000, a federal initiative aimed at increasing the physical and mental health and wellness of individuals living in the U.S. released guidelines, titled *Healthy People 2010* (HP 2010), detailing health recommendations as well as objectives to achieve by the year 2010 (USDHHS, 2000). Specifically, focus area 22 of *Healthy People 2010* set the objective to "[i]mprove health, fitness, and quality of life through daily physical activity". However, despite the numerous health benefits of PA, it has been reported that only 23 percent of adults in the U.S. engage in consistent, vigorous PA for 20 minutes or more, three or more day per week and 40 percent of adults indicated they do not engage in any PA (USDHHS, 2000).

Initial recommendations of PA from the ACSM and HP 2010 suggested that people engage in 20 to 30 minutes of moderate-intensity PA for most, but preferably all, days of the week (Cardinal, 1999; USDHSS, 1996, 2000). More recently, however, the ACSM has stated that initial recommendations for maintaining healthy weights and losing weight were not sufficient (Donnelly et al., 2009). In 2009, the ACSM published a position stand recommending between 150 and 250 minutes per week of moderate PA to prevent weight gain (Donnelly et al.,

2009). Additionally, the ACSM recommends PA greater than 250 minutes per week to promote "clinically significant weight loss" (Donnelly et al., 2009).

In light of these new recommendations and due to the fact that the previous objectives of HP 2010 were not met, *Healthy People 2020*, the current phase in government health initiatives, has modified the previous recommendations. One of the modified recommendations is to increase the proportion of individuals who engage in 150 minutes per week of moderate intensity PA or 75 minutes per week of vigorous intensity PA and increase the proportion of individuals who engage in 300 minutes per week of moderate intensity PA and 150 minutes per week of vigorous intensity PA (USDHHS, 2009). Research on the adoption of PA behaviors across different populations is prolific. A myriad of theories guide these studies. More recent approaches have begun to examine the effect of mediators within these theories. Baron and Kenny (1986) defined a mediator as any variable that "accounts for the relation between the predictor and the criterion" (p. 1176).

The notion of a mediator variable is particularly useful in the context of psychological research. Theory driven interventions highlight a number of causal mechanisms that are hypothesized to change via the intervention, which subsequently change the outcome variable of interest. The utility in testing for mediating variables is that the magnitude of the effect of the mediating variables can be identified so that future studies can tailor their intervention to target the most influential constructs and remove others that do not significantly impact the outcome. This theoretically-based approach to intervention development should improve the effectiveness and efficiency of subsequent interventions (Baranowski, Anderson, & Carmack, 1998; Lewis, Marcus, Pate, & Dunn, 2002; MacKinnon & Dwyer, 1993).

The Baron and Kenny (1986) framework for testing mediation has been available for over 25 years, but few studies in the PA literature have used it to test for mediation. In their review of mediators of PA, Lewis, Marcus, Pate, and Dunn (2002) were able to identify 10 adult and two child studies that examined the direct relationship of an intervention on PA outcomes. Of the 12 studies identified, two used the methods outlined by Baron and Kenny (1986) while the others did not use any validated means of testing mediation. Due to the lack of appropriate mediation testing, Lewis et al. (2002) stated they were unable to make any definitive claims regarding the effectiveness of the mediators in the identified studies.

The mediators that Lewis et al. (2002) identified from the studies reviewed included cognitive processes of change, behavioral processes of change, self-efficacy, decisional balance, social support, and enjoyment of PA. The authors reported that most studies incorporated measures of behavioral processes of change and self-efficacy and that there was evidence suggesting both constructs could likely be mediators in PA interventions. However, both constructs failed to produce significant results in the fourth step of Baron and Kenny's causal steps (Baron & Kenny, 1986). Moreover, some studies found significant effects of the *a* and *b* paths during the one and only measurement time, others found significant effects at certain time points but not others, while a third set of studies did not find any significant effects of the mediators. The authors also noted a number of limitations that diminished their ability to make definitive claims about mediators in PA interventions including: 1) the lack of consistent, valid, and reliable measures of the mediating variables; 2) a lack of studies using control groups and prospective designs, and 3) studies not measuring moderating variables such as time (i.e., the effect of mediators at different time points) and sex.

The issue of measurement reliability is of particular concern because perfect measurement of the mediator and dependent variable is often not achieved, leading to deleterious effects. For example, measurement error in the mediator can lead to an overestimate of the *c* path and either an increase or a decrease in the *a* and *b* paths (MacKinnon, 2008) which ultimately results in a decrease in power (Judd & Kenny, 1981). Baron and Kenny (1986) suggested that one way to overcome this issue is to include multiple indicators of the construct of interest in a structural equation modeling (SEM) framework. This approach is ideal for dealing with measurement error issues and has been recommended for a number years as a useful method of modeling complex theories of PA behavior change (Duncan & Stoolmiller, 1993). By creating a latent construct of the variable of interest, measurement error is modeled within the analysis.

Furthermore, new research suggests that in studies that employ the causal steps method, the increased effect size of the *a* path can actually decrease power to detect mediation (Fritz, Taylor, & MacKinnon, 2012). This occurs when the correlation between the independent variable and the mediator increases, increasing the standard error of *b.* The increase in the standard error of *b,* in turn, decreases the overall power of the test for mediation. In order to address this problem, Fritz et al. (2012) suggest identifying mediators that are more closely related to the outcome variable.

One potential mediator of PA is self-regulation. The literature on self-regulation is rife with theoretical exposition, spanning two books (Baumeister & Vohs, 2004; Boekaerts, Pintrich, & Zeider, 2000), one special issue of *Applied Psychology: An International Review* in 2005, and numerous articles. However, despite the wealth of information available in the self-regulation literature, there is little consensus regarding what self-regulation is, how it mediates behaviors, and what processes are involved within the development and maintenance of self-regulation.

This is in part due to the lack of use of a consistent definition and the variability of constituent components that exists between domains of self-regulation.

Self-regulation

Definition. In the final chapter of Boekaerts et al. (2000) comprehensive review of the field of self-regulation research, Zeidner, Boekaerts, and Pintrich (2000) acknowledge that "…there are almost as many definitions and conceptions of self-regulation as there are lines of research on the topic" (p. 750). Additionally, Zeidner et al. (2000) note that in order for the field to advance in a meaningful direction, a tractable conceptual framework with consistent nomenclature is required. Short of actually claiming to provide an overarching definition of self-regulation, the authors suggest that consistent overlap can be found with regard to conceptualization of self-regulation across domains and theoretical perspectives. Specifically, the authors stated that one can:

> …view self-regulation as a systematic process of human behavior that involves setting personal goals and steering behavior toward the achievement of established goals… [and] self regulation involves *cognitive, affective, motivational,* and *behavioral* components that provide the individual with the capacity to adjust his or her actions and goals to achieve desired results in light of changing environmental conditions. (p. 751)

While this conceptualization does provide a convenient point of reference which future research can use as a common theoretical perspective, it lacks any explication regarding how one attains, improves, or modifies self-regulating behaviors. Zeidner et al. (2000) stated that goals play a significant role in each chapter's conceptualization of self-regulation but that there is little consensus as to what constitutes a goal. Most authors concede that self-regulation involves at

least three functions or stages, including goal setting, goal planning, and self-evaluation/self-monitoring (Bandura, 1986; Carver & Scheier, 2000; Maes & Karoly, 2005). While these three "stages" are a staple of many theories, others have argued that there are more (Vancouver & Putka, 2000). Moreover, these theorists posit that several mediators move individuals through these stages including self-efficacy (Bandura, 1991, 2005), feedback (Carver & Scheier, 2000) and feedforward (Ford, 1992), risk perception (Rosenstock, 1974), outcome expectancies (Bandura, 1977b) action control/attentional focus (Kuhl, 2000), emotions/affect (Carver & Scheier, 2000), and motivation (Deci & Ryan, 1985). The order and importance of these mediators varies from theory to theory.

Additionally, several authors have stated that conceptualizations of self-regulation have moved away from traits and into processes or functions (Bandura, 2005; Cervone, Shadel, Smith, & Fiori, 2006; Karoly, Boekaerts, & Maes, 2005; Leventhal & Mora, 2005). These articles stress the need to shift focus from identifying static traits that are distal representations of self-regulation and to focus more on the mechanism and functions that constitute the process of self-regulation, such as those mentioned above. Karoly et al. (2005) have contended that new measures need to be developed that measure the actual mental processes people use to regulate behavior instead of self-regulation traits. They note that the direction most research seems to be heading in is specialization of self-regulation domains rather than synthesis and consensus across domains. As such, a more prudent and conceptually simpler method for understanding the field of self-regulation is to focus on one domain. The research on health and self-regulation provides a more focused perspective on self-regulation research; although, there is still some variability between theorists even within this domain.

This variability makes understanding self-regulation inherently more complex and difficult. The following section provides an overview of a recent theory of self-regulation for health behaviors that combines components of other theories into one comprehensive approach to self-regulation. Understanding a comprehensive theory of self-regulation will hopefully provide some clarity and structure when specific theories that are less comprehensive are discussed later.

Broad Theoretical Review of Health and Self-Regulation

A recent review of mediators of PA behaviors suggested that self-regulation, more so than self-efficacy and outcome expectancy, is a potential proximal mediator for PA behaviors (Rhodes & Pfaeffli, 2010). The most relevant and comprehensive review of self-regulation within the health domain was provided by Maes and Karoly (2005). They defined self-regulation as a "*goal guiding process,* occurring in *iterative phases,* that requires the *self-reflective implementation of various change and maintenance mechanisms* that are *aimed at task- and time-specific outcomes*" (p. 269). Specifically, they identified three processes through which self-regulation occurs including: 1) goal planning, construal/representation, and setting, followed by 2) actively pursuing goals, and lastly 3) attaining and maintaining goals and goal disengagement when appropriate. The following section gives a brief description of Maes and Karoly's comprehensive goal-guided processes and discusses the components in each of them.

Goal setting. With regard to goal setting, Maes and Karoly (2005) noted that many social-cognitive theories such as Social Cognitive Theory (SCT; Bandura, 1991) have focused on the determinants of intention (e.g., self-efficacy, outcome expectancies), but note that intention has been a poor predictor of behavior. They argue that these models fallaciously assume that 1) goals set *for* individuals are just as powerful goals set *by* the individuals and 2) goal attainment is

a state rather than a process with a distinct sequence through which it unfolds. Instead the authors suggested that Leventhal, Leventhal, and Contrada's (1998) model offered a more accurate depiction of how goal selection occurs. Leventhal et al. highlighted five dimensions along which health threats are represented: 1) the connotative and denotative label of the health threat and the corresponding symptoms, 2) the time it takes a health threat to progress and the time it takes to recover, 3) causal source, 4) perceived outcomes/consequences, and 5) perceived control over the health threat. Maes and Karoly state that representation thusly "defines the goals and reference values for the regulation process" (p. 271)

Maes and Karoly (2005) also suggested that once goals are represented, individuals use "IF—THEN" algorithms to manage the health threat, where the IF is the individual's representation of the threat and the THEN is the action that the individual intends to take to address the health threat. Leventhal et al. (1998) stated that three types of outcome expectancies influence the THEN statements: 1) time-lines, 2) goal-relevance, and 3) dose-response beliefs. Time-lines are the time frames in which the individual expects their actions to take effect. Goal-relevance is the belief or beliefs that guide the selection of actions that are relevant to the perceived threat. Dose-response beliefs determine the severity of response in proportion to the severity of the threat.

Next, Maes and Karoly (2005) stated that studies that incorporated goal-setting into their theories of self-regulation often cited Latham and Locke (1991) as a theoretical basis. While many other domains use goal-setting theory, many health interventions fail to utilize this research (Maes & Karoly, 2005). Latham and Locke stated that in order for goal-setting to have a meaningful impact on performance, the individual should focus on the difficulty level, specificity, conflict, and complexity of the goal content. Additionally, the individual should

consider factors that influence goal intensity (e.g., efficacy and expectancy). Factors that can moderate goal-setting include task complexity, feedback, commitment, knowledge, and ability.

Who sets the goal can have an important impact on self-regulation behaviors. Research by Deci and Ryan on Self Determination Theory (SDT; 2000) has shown that goal autonomy is important for engendering autonomous self-regulation. By allowing the individual to choose goals that are personally relevant, patients have been shown to adhere longer to weight loss trials and to lose more weight (Williams, Grow, Freedman, Ryan, & Deci, 1996).

Goal pursuit. Once a goal is set, one must then begin to develop a plan for pursuing the goal. Inherent to the pursuit of a goal are the intentions associated with the goals and sub-goals. Because of the gap between intentions and behaviors, Gollwitzer (1993) conceptualized "implementation intentions". Implementation intentions outline the situational cues that are the impetus for the intended actions. Maes and Karoly (2005) cited research examples whereby planning specifically when and how a behavior will occur, enhances PA intervention outcomes.

In addition to goal planning (i.e., implementation intentions), Maes and Gebhardt (2000) stated that the mechanisms of self-regulation are influenced by cognitive and affective processes. Ford and Nichols (1991) identified three cognitive processes that influence self-regulation including feedback mechanisms, feedforward mechanisms, and activation of control processes. The affective processes do not necessarily have specific mechanisms, but they simultaneously serve to motivate and provide feedback while co-occurring with cognitive processes.

Feedback. Feedback involves self-monitoring and self-evaluation of one's progress towards one's goal. Feedback loops often involve an input (one's perception of how one is progressing towards a goal), a reference value (the goal), a comparator (the cognitive construct that compares the input to the reference value), and the output function (the action taken either to

correct a behavior to achieve a goal or to continue a behavior to achieve a goal; Carver & Scheier, 1998). In terms of goals, feedback loops act as a method for assessing and correcting discrepancies between one's behavior and one's desired goal.

Feedforward. Feedforward mechanisms are comprised of outcome expectancies and self-efficacy (one's belief in one's ability to perform a behavior; Bandura, 1986,1997). Outcome expectancy is the potential benefit(s) or cost(s) the person expects to experience when he or she engages in the target behavior (for a review see Williams, Anderson, & Winett, 2005). Self-efficacy is gained or lost through the following methods (Bandura, 1997): 1) performance accomplishments, 2) vicarious experience, 3) verbal and social persuasion, and 4) perceptions of emotional and physiological states. Self-efficacy is hypothesized to influence how much effort a person will invest in a behavior and how long they will attempt to engage in the behavior in the face of adverse experiences and obstacles.

Action Control. Action control (Kuhl, 2000) involves processes that aid in the performance of the intended behavior. These processes consist of attentional control (focusing on the goal and inhibiting responses to distracting stimuli), coping with failure (learning from one's mistakes and failures so as to enhance future performance instead of detracting from it by becoming discouraged), emotional control (altering negative mood states that impede goal performance) and motivational control (enhancing the desirability of the identified goal).

Goal Maintenance/Disengagement. In comparison to the previously described processes, Maes and Karoly (2005) provided little more than a brief overview as to the state of the literature regarding goal maintenance and disengagement. This is no doubt due to the fact that maintaining a health behavior such as PA is much more difficult than initiating it. They noted that Rothman (2000) suggests that maintenance is related to one's satisfaction and

expectations one has for the outcomes of the targeted behavior. Goal disengagement is necessary when a goal becomes unattainable. Disengaging from a goal or choosing a more attainable goal can help to improve psychological wellbeing and also increase the likelihood of achieving the new goal (Wrosch, Scheier, Carver, & Schulz, 2003).

Maes and Karoly (2005) also discussed the state of the field as it pertains to the measurement of self-regulation. They discussed several measures that assess each of the processes individually but stated that there are few instruments that measure the process as a whole. While Maes and Karoly's model is comprehensive, addressing both processes and traits, and incorporating overlapping theories, currently, no measures have been developed to assess this model. However, numerous measures have been created based on theories they incorporated into their model such as SCT (Bandura, 1991), SDT (Deci & Ryan, 1986), Transactional Model of Adaptive Control Systems (Ford, 1987), Motivational Systems theory (Ford, 1992), and Implementation Intentions (Gollwitzer, 1993). The following section reviews these specific theories and examines the self-regulation measures based on them that will be used in the current study. The measures, the theories that they are based on, and example items are presented in Table 1. Table 2 lists the psychometric information and constructs each measure is hypothesized to assess.

<Insert Table 1 Here>

<Insert Table 2 Here>

Specific Theories of Self-Regulation

SCT. One of the first theories that identified self-regulation as a proximal mediator of PA behaviors was SCT. Additionally, SCT has been recommended by the Surgeon General as one of the guiding theories for PA (USDHHS, 1996). While there are several constructs within SCT that

are hypothesized to influence PA, including self-efficacy, social support, and realistic positive outcome expectations (Bandura, 1977a, 1977b), Bandura (2004) noted that self-regulation is the essential component. He posited that self-regulation involves goal setting, self-monitoring, self-appraisal, evaluative judgment, and affective self-reaction. Bandura stated that self-regulation is dependent upon consistent and accurate self-monitoring as it helps to form realistic goals, which in turn informs the person of his or her progress towards goal attainment. Bandura (1997) asserted that these SCT variables occur in a very specific causal order; specifically, that social support influences self-efficacy, self-efficacy influences both self-regulation and outcome expectancy, and self-regulation and self-efficacy both independently influence PA behaviors.

Bandura (2005) further posited that self-regulation consists of three components. The first is self-monitoring, which involves observing and assessing one's current behaviors in relation to a desired outcome. The second is the setting of goals to achieve a desired outcome. The third component is self-reactive influences which consist of the incentives and social support we use to sustain the behaviors necessary to achieve a desired outcome. Bandura has also asserted that self-regulation is influenced by two types of feedforward mechanisms: outcome expectancies and efficacy expectations. Efficacy expectations, or self-regulation self-efficacy, is one's belief that one can engage in the behaviors necessary to achieve an outcome despite setbacks and barriers (e.g., "I am confident I can make time to exercise even though I'm busy"). Outcome expectancies refer to one's belief that engaging in a particular behavior will produce the desired outcomes (e.g., "making a plan to exercise will help me to achieve my exercise goal").

Few studies have simultaneously examined, within a multivariate model, which constructs of SCT affect changes in PA behaviors. However, one study by Anderson et al. (2006) did examine the impact of each of the aforementioned constructs in promoting PA in a sample of

999 churchgoers. The findings demonstrated that, overall, SCT accounted for 46% of the total variance in PA with self-efficacy, social support, and self-regulation (as measured by participants' actual self-regulation behaviors and self-regulation self-efficacy) accounting for significant portions of variance, 14%, 13% and 35% respectively. In a prospective design, Rovniak, Anderson, Winett, and Stephens (2002) examined how self-efficacy, social support, outcome expectancy, and self-regulation impacted measures of PA behavior. This study also found that SCT variables had a significant impact on PA behavior, accounting for 55% of the variance with self-regulation having the largest direct impact on PA. Social Cognitive Theory has been widely cited as the theoretical underpinning for many PA interventions (Anderson, Winett, Wojcik, & Williams, 2010; Anderson, Wojcik, Winett, & Williams, 2006; Dishman et al., 2005; Napolitano et al., 2008). It provides a comprehensive approach to understanding how self-regulation is influenced by other factors and how self-regulation influences PA.

Measures. Several measures are purported to be based on SCT, including measures created by Dishman et al. (2005), Dishman et al. (2010), the Health Belief Survey (HBS; Anderson et al., 2006), Rovniak et al. (2002) and Petosa (1993). The two measures by Dishman et al. (2010) and Dishman et al. (2005) claim to be based on SCT, but an examination of the referenced literature indicates the measures were created based on self-regulation strategies targeted in a cognitive and behavioral intervention intended to increase PA. These strategies included goal setting, weighing costs and benefits (i.e., outcome expectancies), positive self-talk, stress management, increasing enjoyment, increasing social support, activism for PA, time management, and relapse prevention. No mention was given in the articles containing the measures on how the items were created or why they chose certain items over others.

The Dishman et al.'s (2005) measure contained three cognitive and three behavioral strategies. An example of a cognitive strategy question is "I think about the benefits I will get from being physically active", while an example of a behavioral strategy question is "I make back-up plans to be sure I get my physical activity". The Dishman et al.'s (2010) measure contained four cognitive and four behavioral strategies. An example of a cognitive strategy question is "When I get off track with my physical activity plans, I tell myself I can start again and get right back on track", and an example of a behavioral strategy is "I set goals to do physical activity". The item content would suggest that these questions measure several different components of self-regulation including goal-setting, outcome expectancies, and goal planning.

The HBS (Anderson et al., 2006) assesses how often, within the past two months, participants used 14 self-regulation strategies such as walking instead of driving, setting aside time to walk or do other exercise, or setting a goal for the number of days to walk. Looking at the items in the measure, the items seem to assess goal setting, goal planning, social support, and self-monitoring strategies, yet the authors claim that the measure is unidimensional. Examples of these constructs include: goal setting, "Set goals for how long your walking or exercise session will be"; goal planning, "Make a plan to walk or do other exercises"; social support, "Get together with someone else to walk or do other exercise"; self-monitoring, "Keep track of how fast you walked or how hard you did other exercise". While the article purports to use SCT as the basis for the measure, there is no explanation as to how these variables conform to Bandura's conceptualization of self-regulation. Questions assessing self-monitoring and goal setting relate explicitly to Bandura's conceptualization of self-regulation, but questions assessing goal planning seems to extend beyond Bandura's model of self-regulation.

The last measure created using SCT is from Petosa (1993). Petosa conducted a literature review of "self-management" and, based on his review, created a 51-item measure assessing 12 different components of self-regulation including self-monitoring, goal setting, behavioral cues (e.g., reminders to exercise), social support, environmental aids (e.g., changing the environment to facilitate exercise), modeling, reinforcement contingencies, compatible habits (e.g., pairing exercise with other enjoyable activities), time management, perceived barriers, relapse prevention, and behavioral contracting. Several constructs such as self-monitoring, goal setting, and social support and reinforcement contingencies, representing self-reactive influences, align with Bandura's conceptualization of self-regulation. However, many of the others are not explicitly part of his theory. Perceived barriers and relapse prevention could be construed as self-regulation self-efficacy, but that is not explicitly stated. Unfortunately, Petosa does not state which items map on to which constructs. Moreover, he does not hypothesize a theoretical order to these various components nor does he explicitly state how they relate to SCT.

SDT. Another theory that specifically incorporates self-regulation into a broader theoretical framework is SDT (Deci & Ryan, 1985). In the broadest sense, SDT focuses on understanding the intrinsic or extrinsic motivations individuals experience that elicit behaviors. Cognitive evaluation theory (CET) and organismic integration theory (OIT) are two sub-theories of SDT that have received ample research attention for their ability to differentiate and elucidate a person's motivations. Cognitive evaluation theory posits that psychological needs such as competence (self-efficacy for the targeted behavior), autonomy (a feeling that one is the originator of the motivation), and relatedness (the sense that engaging in the behavior connects one to others) facilitate a person's willingness to engage in a behavior. This theory suggests that social-contextual events, such as rewards, communication, and feedback, enhance one's feelings

of competence, which ultimately increases one's motivation. In order for a sense of competence to be developed, it needs to co-occur with feelings of autonomy. Both are required to elicit intrinsic motivation and enhance performance (Ryan, 1982).

Autonomy is influenced by self-acknowledgment of feelings, situations allowing for self-direction, and choice. These components have all been shown to increase autonomy (Deci & Ryan 1985) and subsequently, increase intrinsic motivation (Flink, Boggiano, & Barret, 1990). Relatedness has also been shown to affect intrinsic motivation in students who felt their teacher was cold and cut off (Ryan & Grolnick, 1986), but, as many behaviors are engaged in isolation, the role of relatedness in the context of intrinsic motivation is not fully understood (Ryan & Deci, 2000). In the context of PA, someone who is intrinsically motivated would 1) feel competent that they could engage in the desired behavior and that behavior would result in the desired outcome, 2) feel that their desire to engage in the PA behavior is not being coerced or forced upon them, such that engaging in the behavior fulfills a personal value, and 3) feel supported in the PA behavior and, potentially, feel that engaging in the behavior makes them more connected to others.

Organismic integration theory (OIT), the second sub-theory, attempts to explain how extrinsically motivated behavior is regulated (Deci & Ryan, 2000). The main objective of OIT is to identify the process through which externally regulated behaviors become internally regulated. This theory is comprised of four types of regulation, including external, introjected, identified, and integrated. These types of regulations can be thought of as being on a continuum of self-determination with external regulation being the least self-determined and integrated being the most self-determined. Externally regulated behaviors are usually performed in order to comply with an external request, to obtain an external reward, or avoid an external punishment (i.e.,

exercising because I am being told to exercise). Introjected regulation is more self-determined than external, but still involves a somewhat external locus of control. For example, introjected regulation may involve engaging in behaviors in order to avoid anxiety or guilt (i.e., exercising because I will feel guilty if I do not). These behaviors have an internal component (i.e., the regulation of internal states) but the motivation is primarily external.

Identified regulation is the next most self-determined type of regulation and involves engaging in a behavior because of the importance, usefulness, or value to the individual (i.e., exercising because I value being healthy but not because I enjoy PA; Ryan & Deci, 2000). Lastly, integrated regulation involves the assimilation of identified regulatory processes into the self so that behaviors are engaged in willingly (i.e., exercising because I want to). Integrated regulation is very similar to intrinsic motivation, with the main difference between the two being that one is intrinsically motivated if one enjoys or has interest in the behavior (i.e., I exercise because I enjoy it), whereas integrated regulation is characterized as engaging in the behavior because of the behavior's importance to a self-identified value (i.e., I exercise because I want to be healthy; Ryan & Deci, 2000). This distinction between intrinsic motivation and integrated regulation appears to be a semantic one, in that in the above described difference, Ryan and Deci appear to be describing identified regulation. This tautological description of integrated regulation, while not discussed explicitly in the literature, presents obvious measurement issues.

Behaviors can move along the continuum of self-determination, from externally regulated to intrinsically regulated, as one's experiences increase one's perceived autonomy, competence, and relatedness (Vlachopoulos, Kaperonietal, Moutsaka, 2010). In PA interventions these constructs are targeted in order to increase individuals' more self-determined regulatory processes. In a randomized control trial targeting PA and weight loss, researchers implemented

an intervention to increase participants' sense of autonomy by encouraging participants to examine their motivation for treatment, allowing them to define their treatment goals, and providing them with a range of options to help them achieve their treatment goals (Silva et al., 2011). Results from this study suggest that integrated and identified regulation of behaviors was a significant mediator of PA at two-year follow-up and weight loss at three-year follow-up. External and introjected regulation were not significant mediators of these relationships.

Measures. In an article by Mullan, Markland, and Ingledew (1997), the authors set out to develop a measure that specifically assessed intentions, three types of regulation for extrinsically motivated behaviors, and intrinsic motivation. These types of regulation come from OIT and include external regulation, introjected regulation, and identified regulation (Deci & Ryan, 1986). Items were developed by taking previous items from two measures designed to measure the four types of regulation in academics. The questions were then reworded to assess exercise behavior. The following is a list of example items for each of the different types of regulation: 1) external regulation, "I exercise because people say I should"; 2) introjected regulation, "I feel guilty when I don't exercise"; 3) identified regulation, "It's important to make the effort to exercise regularly"; 4) intrinsic motivation, "I enjoy my exercise sessions". Mullan et al. (1997) do not mention integrated regulation and instead use Deci and Ryan's (1986) conceptualization of intrinsic motivation as the fourth subscale in their measure.

Implementation Intentions. While not an explicit theory of self-regulation, implementation intentions serve as a critical bridge between intentions and behaviors in many social cognitive theories. Implementation intentions are the plans one makes, after a goal is set, in order to achieve this goal (Gollwittzer, 1993). Implementation intentions are formed through a two-step process whereby an individual 1) identifies a cognitive or behavioral response that will

help to achieve a chosen goal and 2) determines under what conditions he or she should initiate said response. For example, if someone's goal or intention was to exercise, an applicable implementation intention may be to walk for 30 minutes outside every day at 12:30PM. In this example, every day at 12:30PM serves as the situation and the response is to walk outside for 30 minutes. Implementation intentions serve as a means to identify ahead of time situations in which a person should initiate a behavior or cognition and help to delineate clear responses to those situational cues.

In a meta-analysis of studies examining the relationship between implementation intentions and various goal achievements, Gollwittzer and Sheeran (2006) included several studies that examined engaging in PA as the goal. The effect sizes (Cohen's *d*) for these studies ranged from small (.18) to very large (1.25), with most effect sizes in the medium classification (i.e. > .5), which suggests that implementation intentions are an important component of goal achievement for PA behaviors.

Measures. Implementation intentions can obviously range in their type and specificity, but much of the original literature does not differentiate between them. Sniehotta, Schwarzer, Scholz, and Shuz (2005) hypothesized that certain plans help in the initiation of goal-directed behaviors (action planning) while other plans help to overcome barriers to goal-directed behavior (coping planning). Sniehotta et al. (2005) created and validated measures of action planning and coping planning, and then administered the measures to individuals with coronary heart disease (CHD) who had recently completed treatment at a rehabilitation center. Examples of action planning from that measure include, "I have made a detailed plan regarding when to exercise" and "I have made a detailed plan regarding how often to exercise". Examples of coping planning include "I have made a detailed plan regarding how to cope with possible setbacks" and "I have

made a detailed plan regarding what to do in difficult situations in order to act according to my intentions".

Through their research, Sniehotta et al. (2005) demonstrated that coping planning was a better predictor of PA behaviors in individuals with CHD than action plans or intentions. However, the results also indicated that coping plans only became a significant predictor at later time points, indicating that coping plans require experience in order to be developed. Action plans were not a significant predictor of physical activity at any time point.

Transactional Model of Adaptive Control Systems. While the theories described above have received the most attention in the psychological literature, two lesser known, but arguably more comprehensive theories also provide insight into the regulatory processes of human behavior. The first is D. Ford's (1987) Transactional Model of Adaptive Control Systems. This model is complex in that he provides a basic mechanistic explanation for how physical structures interact with the environment. He then expands his model to include more complex human models that incorporate biological and genetic components. For simplicity, only a brief overview of a simple control system and a brief description of an adaptive control system are provided.

In D. Ford's (1987) simple control system, he posits that several regulatory processes are organized and contained in a physical structure (a person in this instance) that allows the structure to interact with the external environment. First is the command function, where a person specifies a goal or outcome. Next this information is fed forward to a comparator/regulating function that determines the state of the person in relation to the desired goal. If the state of the individual is different than the desired goal, then information is fed forward to control function that determines the appropriate action. This information is then fed forward to an action function that performs the action on the "relevant environmental variable".

Information on how this action affects the environment and the individual is collected in an information collection function and fed back to the comparator/regulating function. This process continues until the desired outcome is achieved. An adaptive control system is the same as a simple control system, but it allows for multiple goals, feedback mechanisms, feedward mechanisms, actions, and regulatory processes.

When the adaptive system is applied to humans (called a living system; Ford, 1987), several components of each of the functions are specified in order to explicate what cognitive processes constitute each function. For clarity, a simplified figure of this model is presented in Figure 1. In this model, D. Ford outlines three governing functions (direction, regulation, and control), three sensory-perceptual-motor functions (action, information processing, and information storage) and one arousal function (emotion). In the living systems model, emotions serve as the energy for the system. The governing functions serve similar functions as the ones described above where the direction function is the command function in the adaptive system. In the living systems model the governing functions provide the overarching goal-guided processes involved in coordinating, evaluating, and planning regulatory responses to environmental variables. The sensory-perceptual-motor functions serve as the interaction between the environment and the governing processes. The arousal function can have a diffuse impact within the system, affecting regulatory processes by increasing or decreasing awareness of information and create anticipatory states based on previous emotional experiences, which can help to enhance the development of regulatory processes. Several components are specificed which overlap with many of the theories for self-regulation mentioned above, including goal setting, expectations, and planning.

Measures. Using D. Ford's (1987) theory as a foundation for understanding self-regulation, Ruehlman and Karoly (1995) developed the Goals and System Battery (GSAB). The GSAB measures a person's governing functions and arousal functions when setting PA goals. Ruehlman and Karoly state that because the sensory-perceptual-motor functions are integrated within the governing functions, they do not need to be directly measured. Within each of the four functions, the authors identify a number of subscales. The directive function contains two subscales called value and self-efficacy, while the regulatory function also contains two subscales called social comparison and self-monitoring. The control function contains three subscales call planning/stimulus control, self-criticism, and self-reward, and lastly, the arousal function contains two subscales called positive affect and negative affect. In a study examining the relationship between exercise motivation, goal processes (as measured by the GSAB), and self-reported exercise behavior, Lutz, Karoly, and Okun (2008), found that, of the nine subscale the GSAB measures, planning, positive affect and self-monitoring were significant mediators of the relationship between exercise motivation and exercise behaviors.

Example items for each of these components include: value, "This goal is important to me"; self-efficacy, "I possess the necessary skills to attain this goal"; social comparison, "I evaluate my progress on this goal by comparing myself to people who are also working on it, but are doing worse than I am"; self-monitoring, "I keep track of my overall progress toward this goal"; planning/stimulus control, "I try to plan out in advance the steps necessary to reach this goal"; self-criticism, "I routinely criticize myself for unsatisfactory work on this goal"; self-reward, "I reward myself for working hard on this goal"; positive affect, "working toward this goal is exciting"; and negative affect, "Working on this goal makes me feel somewhat panicky".

Motivational Systems Theory. M. Ford's (1992) Motivational Systems Theory (MST) is a theory of motivation that was developed from D. Ford's (1987) living systems theory. In it M. Ford outlines 17 principles that are hypothesized to increase motivation including: 1) unitary functioning, 2)motivational triumvirate, 3)responsive environment, 4)goal activation, 5)goal salience, 6)multiple goals, 7)goal alignment, 8)feedback, 9)flexible standards, 10)optimal challenge, 11)direct evidence, 12)reality, 13)emotional activation, 14) "do it", 15)incremental versus transformational change, 16)equifinalty, and 17)human respect.

Motivational Systems Theory (Ford 1992), while purportedly based on D. Ford's (1987) living systems model, appears to be more of a loose clustering of motivational techniques rather than a comprehensive theory of motivation or self-regulation. As such, there is no description of how these principles interact with one another nor is there a specified causal order in which these principles should occur.

Measures. Maes, Pomaki, Joekes, Boersma, Gebhardt, and Huisman (2001) created a measure for self-regulation consisting of 13 subscales including feedback/attainability, external control, goal commitment, goal alignment, goal conflict, goal efficacy, goal outcome expectancies, goal-related positive emotions, goal-related negative emotions, goal communicative actions, goal support, and goal pressure. Example items for each of the subscales include: 1) feedback/attainability, "It is difficult for me to achieve this goal"; 2) external control, "My attainment of this goal depends on external factors"; 3) goal commitment, "Whatever happens I will not give up on this goal"; 4) goal alignment, "This goal contributes to the attainment of other goals I have"; 5) goal conflict, "This goal makes it difficult to reach other goals I have"; 6) goal efficacy, "I have a clear idea of what it takes to achieve this goal"; 7) goal outcome expectancies, "If I achieve this goal I will feel more competent"; 8) goal-related

positive emotions, “I feel happy when pursuing this goal”; 9) goal-related negative emotions, “I feel anxious if I do not make progress toward this goal”; 10) goal communicative actions, “I ask others to help me to achieve this goal”; 11) goal support, “My partner supports me in my pursuit of this goal”; 12) goal pressure, “My partner puts pressure on me to attain this goal”; 13) goal rejection “My partner disapproves of the way in which I pursue this goal”.

While some of the subscales map on to the principles in the MST (Ford, 1992), such as goal alignment, feedback/attainability, and positive/negative emotions, several do not, including goal communicative actions, goal pressure, and goal support. Additionally, other principles are omitted entirely. Maes et al. (2001) did not state why they included certain subscales and not others.

Theoretical Issues

The above review reveals that understanding self-regulation across theories is not a simple process; however, there are some similarities across the individual theories (i.e, SCT, SDT, Implementation Intentions, Transactional Model of Adaptive Control Systems, and MST). The first is that, with the exception of MST, the theories agree that self-regulation is a dynamic process and not a trait. That is, they posit that there is a temporal sequence to self-regulation that occurs. Another similarity is the consensus that goal setting is the first component of the process of self-regulation. Several theories posit that one’s perceived competency or self-regulation self-efficacy is an important component of self-regulation including SCT, SDT, and MST. Lastly, all four theories incorporate some form of self-monitoring and feedback into their processes of self-regulation.

Unfortunately, the differences between the theories appear to outnumber the similarities. While each theory concedes that goal setting is the first step in the process of self-regulation,

there is no consensus on the order or number of components in the process. Moreover, for two of the theories (SCT and MST), it was not clear how the measures related to the theories they were based on. Even for the constructs that overlap between theories, there is not enough theoretical exposition to determine if the conceptualization of these constructs is the same. For example, none of the theories above explicitly state how a goal should be set or how goals are constructed within the hierarchy of other goals. Latham and Locke's (1991) model explicitly outlines the methods through which goals should be set, but none of the four theories described above cite this model. The inconsistency in which the constituent components of each model are conceptualized can lead to meaningful differences in the measurement of these components and ultimately inhibit our understanding of these processes.

While much of the theoretical conjecture regarding self-regulation concerns the components, little discussion is given as to what constitutes the process of self-regulation. Based on the theories outlined above, it would appear that the process involves the change in the levels of each component across time. For example, goal-setting and self-efficacy may be important components of self-regulation in the initial stages of adopting PA behaviors, but over goal-monitoring and goal planning become better predictors of PA behaviors. This process can only be captured through proper longitudinal methodologies.

Methodological Issues

There are a number of methodological and psychometric concerns regarding the measures used to assess self-regulation. One glaring methodological concern regarding the measurement of self-regulation is the lack of understanding of the process through which self-regulation occurs. While the theories above outline the processes of self-regulation, PA studies using these measures either measure each of the components cross-sectionally (Lutz, Karoly,

Okum, 2008; Mullan, Markland, & Ingledew (1997) or use a scale score or latent variable representing a general self-regulation construct (Anderson et al., 2006; Rovniak et al., 2002). Measuring the components cross-sectionally can be particularly dangerous in terms of the interpretation of the process because relationship between the components and the outcome is predicated on the measurement time points. For example, as noted by Sniehotta et al. (2005), certain types of planning require experience before they can develop and become significant predictors of PA. The same could be said for self-monitoring and self-regulation self-efficacy.

There are also several psychometric issues with the identified measures of self-regulation. An examination of these measures in Table 2 reveals that there is only one measure with exploratory factor analysis (EFA) information. In terms of developing measures, EFA should always be used as a first step, because it makes no assumptions regarding which items load on which construct or the number of factors. In EFA, the number of factors to retain is determined by the statistical relationship among the variables. (Floyd & Widaman, 1995). In this sense, EFA allows researchers to empirically identify factors that may manifest from the theoretically derived items. This stands in contrast to confirmatory factor analyses (CFA's), which require the researcher to already know the factor structure of the measure and specify a priori the loadings for each item to each corresponding construct.

From a theoretical standpoint, each measure of self-regulation included in Table 1 could potentially be measuring different aspects of self-regulation. Due to the lack of consensus regarding the conceptualization of self-regulation, this is very likely to be true. At this time, no research exists which evaluates the current measures of self-regulation against one another. Currently, there is no empirical understanding of which constructs constitute self-regulation, how many constructs there are, how these constructs influence PA, or how the measured constructs

relate to the theory from which they are derived. In order to understand the role of self-regulation in influencing PA, it is necessary to develop and test measures that are valid and reliable. In order to demonstrate the validity of a measure, researchers must show that the construct being measured is the same construct they have delineated in their theory. This area of research within the self-regulation domain has reached a critical mass whereby enough theories and measures exist to demonstrate the validity of self-regulation and its measures.

Current Study

The current study hopes better understand the constituent components that comprise the process of self-regulation. Given the vast array of theoretical perspectives and the multiple measures of self-regulation identified in Table 1, the present study hopes to identify a common factor structure from the existing measures by conducting a separate EFA and CFA on all noted measures. By using existing measures with established theoretical bases, common variance between measures can be identified while simultaneously isolating and removing items that do not load onto any factors and may not be assessing self-regulation. Identifying common variance between measures should result in the identification of statistically stable factors of self-regulation, which will improve models of self-regulation and their measures. Moreover, using existing measures reduces the theoretical and psychometric clutter within the field.

In addition to examining the validity of the measures, the reliability of the self-regulation constructs can be improved upon as well. Many of the measures only have 10 items. The factor analyses may identify more items that should be included in a measure of self-regulation. By increasing the length of the measures, without being redundant, one can increase the reliability of the measure and decrease the measurement error. Based on the overlap between the theories described above and on the theory outlined by Mae and Karoly (2005) it is hypothesized that

several overlapping factors will emerge in the final model. Specifically, it is hypothesized that goal setting, goal planning, self-monitoring, and self-regulation self-efficacy will emerge as factors common to several of the theories and measures discussed above.

Once a stable factor structure has been identified via EFA, and tested via CFA, the identified factors and their corresponding items are examined to determine which theoretical constructs have manifested. Given the vast information on the theoretical perspectives of self-regulation, the theory or theories that most closely resemble the identified factor structure are delineated. The current study only attempts to identify the components of self-regulation and does not attempt to determine the process; specifically, in what the order of the components should occur, and which components are better predictors of different stages of PA.

Methods

Participants and Setting

Participants were recruited from the online research system, SONA, at Virginia Tech and through the graduate student listserv. A total of 1,573 people responded to the survey, which was administered online through SurveyMonkey. Of those individuals, 12 indicated they did not give consent and were removed. Of the remaining participants, 71 did not complete 50% or more of the questions and were deleted, leaving a total of 1,490 participants. Participants were then randomized to either the EFA analyses or the CFA analyses.

EFA. There were 750 participants included in the final EFA analyses. Participant ages ranged from 18 to 37 years old, with the average age being 19. Participants were predominantly Caucasian (78.8%) and female (69.47%). Demographic information for participants in the EFA analyses is provided in Table 3.

<Insert Table 3 Here>

CFA. There were 740 participants included in the final CFA analyses. Participant ages ranged from 18 to 52 years old, with the average age being 19. The demographic information for participants is similar to individuals in the EFA analyses, with participants being mainly Caucasian (77.60%) and female (66.09%). Demographic information for participants in the CFA analyses is provided in Table 4. T-tests assessing for differences in age, gender, and ethnicity between the EFA and CFA samples resulted in non-significant differences for all three demographic variables.

<Insert Table 4 Here>

Measures

A combined measure of self-regulation was created by merging nine smaller, previously created measures of self-regulation. Psychometric information regarding these measures, including the number of items, the number of factors, and reliability and fit indices, is presented in Table 2. All items are rated on a Likert scale ranging from "1" to "5" with the exception of the measure from Sniehotta, Schwarzer, Sholze, and Shuz (2005) which ranges from "0" "completely disagree" to "4" "completely agree". Each measure is hypothesized to be measuring self-regulation; however, the constructs that comprise self-regulation vary from measure to measure. All measures were administered in their entirety, however only 38 of the 50 items from the GAPI (Maes, Pomaki, Joekes, Boersma, Gebhardt, & Huisman, 2001) were included in the final analyses. The last 12 items of the measure, pertaining to goals and a respondent's significant other, were removed as more than half of the respondents indicated that they did not have significant others.

Each questionnaire included different directions, such as "Please tell us what strategies you have used in the past 2 months to successfully walk or do other exercise." or, "Pick the <u>most important</u> personal health-related goal that you are currently pursuing [and answer the following questions]." The directions for each measure were maintained and each measure was presented as it was originally conceived, with each subsequent measure following the previous. This method of administration was chosen in order to maintain the integrity of each questionnaire and what it was intended to measure.

A measure of PA was also included in order to assess the concurrent validity of the final self-regulation measure created through the EFA and CFA analyses. Physical activity was assessed through the International Physical Activity Questionnaire Short Form (IPAQ; The International Physical Activity Questionnaire, 2002). The IPAQ is a previously validated

measure of PA that assesses three forms of PA including walking, moderate PA (e.g., "activities that make you breathe somewhat harder than normal") and vigorous PA (e.g., "activities that make you breathe much harder than normal"). Each facet is assessed within the past seven days and asks how many hours and minutes the person engages in each type of PA. The IPAQ has demonstrated acceptable reliability and validity, particularly among college students (Dinger, Behrens, & Han, 2006). The online measure is presented in its entirety in Appendix A.

Procedures

Through the recruitment procedures listed above, participants were directed to the survey link. Once participants clicked on the web address, they were prompted to complete the informed consent page. Participants were asked to acknowledge that they had read and understood the informed consent by clicking the "Agree" button in order to proceed; otherwise they were directed to the exit screen. Following the informed consent page, participants were directed to a screen where they were prompted to fill out demographic information such as age, gender, and ethnicity.

Following the demographics page, participants were presented with a screen that provided them with the goal of the study and what was expected of them as participants. Specifically, the message informed participants that they would be filling out several measures that were attempting to assess an individual's self-regulatory thoughts and behaviors with regard to PA. The message advised participants that because the study was attempting to compare multiple measures, they would be asked questions that resembled ones they had already answered, but were, in fact, different. It was communicated to participants that it was imperative that all questions be answered despite perceived repetition.

Once participants acknowledged that they had read and understood the instructions, they were directed to a page that asked them to click on a link to a separate webpage with a number on it. On that page, they were asked to enter the first digit of the number. The number was a simple counter that tracked how many people had visited that webpage. Depending on what number they entered, participants were then directed to one of 10 different combinations of the 10 different measures. A Latin Square design was used to assess for any ordering effects by creating 10 different orthogonal orders. After participants entered their order number, they were presented with the first measure and directions for that measure. Each participant was asked to click on the Likert rating for each item. After they completed each measure, a new measure with separate directions was presented to them. Once they completed all measures, they were prompted with a screen thanking them for their cooperation.

Analyses

The three main objectives of the psychometric analyses were to: identify overlapping factors across measures; maintain theoretical interpretation of the identified factors; and, eliminate as many items from the overall measure, without detracting from the interpretability, validity, or reliability of the factors. However, there is currently no literature on how to quantitatively compare and contrast different measures of the same or similar constructs, nor is there literature on how to remove items from these overlapping measures. Using the objectives described above, feedback was elicited from two quantitative psychologists and the following analytic method was outlined and conducted (M. S. Fritz & R. Millsap, personal communication, April 10th, 2012). The proceeding sections provide 1) the general analytic method used for the identification of the factor structure as well as the removal of items from the original 204 item measure, 2) specific information on how the EFA's and CFA's were conducted, 3) specific

information on how the concurrent validity analyses were conducted and 4) the methods used to address missing data. Specific information regarding the number of factors retained, why those factors were retained, and which items were removed are presented in the results and discussion section.

Retaining Factors and Eliminating Items. The analyses followed the below steps.

1) Using EFA, a 25-factor solution with all 204 variables was estimated and, using the pattern matrix, all items that loaded less than 0.4 were eliminated.

2) Using the items retained from the previous step, a 12 factor EFA solution was estimated using the EFA data and all items that loaded less than 0.4 were eliminated.

3a) Using the items retained from the previous step, several factor solutions, ranging from 5 to 12 factors, were estimated and a scree plot (Cattell, 1966) was requested to suggest the optimal number of factors to include in the final model. Using the theories described above, the interpretability of each factor solution was examined to determine which of the different factor solutions made the most theoretical sense (discussed in detail below). The process of examining the factor structure involved organizing the factors and their respective items into a database, color coding each item to represent the construct it is supposed to represent in the original measure, and comparing each item on each factor to determine if there was any theoretical overlap between the items. Additionally, the item content was examined to ensure there was no ambiguity in the interpretation of the constructs. Theory, instead of fit indices, was used to determine the factor structure for the range of factors solutions because fit indices would always suggest more factors, regardless of the interpretability of the factors. After identifying the factor solution that made the most theoretical sense, all items that loaded less than 0.4 in the pattern matrix were removed.

3b) Utilizing the factor solution from the previous step, the CFA data was used to fit a CFA model. Each item was specified to load on the factor from the EFA results and any items that did not load from the EFA in the previous step were specified to load on all eight factors in the CFA model in order to ensure that differences in loadings between samples was not merely due to sampling error. Then, any items that loaded less than 0.4 in the completely standardized solution were removed.

4a) Using the items retained from Step 3b, a factor solution ranging from five factors to one more factor than the number of factors in the best fitting EFA solution in the previous step was run using the EFA data. Following the same procedures as in step 3a, the different factor solutions were examined to determine the best factor solution based on theoretical interpretability. Once a factor solution was chosen, all items loading less than 0.4 in the pattern matrix were removed.

4b) Using the procedures from step 3b, the factor solution from the previous step (Step 4a) was used to fit a CFA model with the data from the CFA data.

5) Steps 4a and 4b were repeated until no further items were deleted from either model.

6) Using the model from step 5, the modification indices and expected parameter change (EPC) values were examined, and error terms were correlated if modification indices and EPC values were sufficiently large and made substantive sense (discussed in detail below). Using the model from the previous step, a final CFA was run with correlated error terms and the fit indices were examined to determine the adequacy of the model in terms of representing the data.

7) Using the model from the previous step, a higher-order model was specified with each of the factors from the previous step used as indicators for a higher order factor. Given that many authors have argued that there are multiple constructs associated with self-regulation and that

several of the measures included in these analyses hypothesized multiple constructs, a higher order factor structure was assessed using a χ^2 difference test and examining the higher order loadings;

8) The best-fit model (from either step 6 or step 7) was identified and convergent validity was assessed by regressing a latent PA variable on the self-regulation factors.

The method outlined here can be considered an inductive method for retaining and interpreting factors. That is, this method utilizes a largely statistical method for determining which items to retain and then using the item content of the retained factors to interpret the factors. An alternative method would be to use a deductive method whereby the researchers define what constructs comprise self-regulation, then choose which items to retain based on the face validity of the items in relation to the construct the item is hypothesized to measure.

The inductive method was chosen over the deductive method because inductive method makes no assumptions about the components that comprise self-regulation. Additionally, items chosen based on their face validity may eliminate important items that capture significant variance in a component. The downside of using the inductive approach is the potential to produce factors that have items from different hypothesized components (i.e., items from both planning and goal setting), thus making the factor difficult or impossible to interpret.

EFA. Before beginning the data analysis, the data were assessed to ensure multivariate normality by examining the skewness and kurtosis. For the EFA, the data were analyzed using M*plus* version 6.0 (Muthén & Muthén, 2010). Maximum likelihood extraction method with a geomin rotation was used for the EFA analyses. Maximum likelihood is a popular method for extraction in common factor analysis, and is useful because it can provide a number of fit indices that can be examined to determine how well the hypothesized model fits the data. Geomin

rotation was chosen because it is an oblique rotation. Oblique rotations allow the factors to correlate, which seems to conform to the theoretical perspectives of self-regulation described above. However, because the factors are correlated, the interpretation is not as straightforward as with orthogonal rotations such as varimax. Additionally, geomin is designed to minimize variable complexity in order to better achieve simple structure (Sass & Schmitt, 2010).

In addition to conducting an EFA on all 204 variables, separate EFA's were conducted for all of the individual measures in order to determine if the factor structure identified in the original articles could be reproduced. The fit indices used were the Root Mean Square Error of Approximation (RMSEA), the Tucker-Lewis Index (TLI), and Akaike Information Criterion (AIC). The χ^2 values were also reported, however, as this has been shown to be sensitive to sample size, it was used in conjunction with the other fit indices. Reliability was estimated via point estimates as Cronbach's alpha assumes that the items of one construct are uncorrelated with other constructs, which is not true in EFA (Raykov & Marcoulides, 2010). Point estimates for items that are correlated provide a less biased estimate of reliability.

CFA. M*plus* version 6.0 (Muthén & Muthén, 2010) was used to conduct the CFA analyses. Data were examined to determine that they were multivariate normal by examining skewness and kurtosis. Again, maximum likelihood was used as the method of estimation. The fit indices used to assess model fit for the CFAs include the Comparative Fit Index (CFI), the TLI, and the RMSEA. The CFI is another fit index that assesses the fit of the model but also decreases with each factor included in the model in order to ensure a parsimonious model is developed. Fit indices and cut off values were chosen based on the recommendations of Hu & Bentler (1998, 1999) who suggest that these indices are not as sensitive to issues with samples

size as the Chi-square is and the CFI provides more accurate estimates when using ML (although it is sensitive to complex estimation models).

Modification indices and expected parameter change (EPC) values were examined to determine if any of the error terms should be correlated to provide a better fit. From a theoretical perspective, it would make sense to correlate any items from the same measure, provided they have sufficiently large modification indices and EPC values. As with the EFAs, the original factor structures were compared to the obtained factor structures. The final multi-factor model was also assessed to see if there was a higher order structure by creating a model with the EFA identified factors that loaded on to a higher order factor called "Self-Regulation". Again, point estimates were used in lieu of Cronbach's alpha to estimate reliability because modification indices and EPC values suggested several items should have correlated errors.

Concurrent Validity. In order to assess the concurrent validity of the overall model developed from the reduced 204 item pool, a structural model was examined using the constructs from the overall model as the exogenous variables and a latent PA variable as the single endogenous variable. The latent variable for PA was created using the three PA indicators from the IPAQ (e.g., walking score, moderate PA score, and vigorous PA score). The regression paths for the constructs were used to assess concurrent validity.

Missing Data. Missing data were handled using the Full Information Maximum Likelihood (FIML) approach for extraction in the EFA and estimation of the CFA. Enders and Bandalos (2001) have noted that compared to listwise deletion, pairwise deletion, and multiple imputation, FIML provides more efficient and unbiased estimates when data are missing completely at random or missing at random.

Results

Descriptive Statistics

EFA. All items used in the EFA were determined to be univariate normal, having values of skewness and kurtosis less than 2.00 except for two items that had kurtosis less than 2.5. Additionally, frequencies were run to determine the amount of missing data within the items. Missing data for all items ranged from 0.67% to 3.47% missing. Descriptive statistics, including the percent of missing data for each item, are provided in Table 5. A one-way ANOVA was conducted using the order in which the surveys were administered as the independent variable, to determine if order influenced respondents' answers. A scale score was calculated by summing the 204 items and the scale score was used as the dependent variable. Results of the ANOVA suggest that the order of the surveys did not influence respondents' scores, $F(9, 740) = 1.47$, $p = 0.157$. Before the EFA was run, one item was removed from the analysis as it was worded exactly the same as one of the other items.

<Insert Table 5 Here>

CFA. All items used in the CFA were determined to be univariate normal, having values of skewness and kurtosis less than 2.00 except for one item that had kurtosis less than 2.4. The CFA data had missing data ranging from 0.81% to 3.38%. Descriptive statistics, including the percent of missing data for each item, are presented in Table 6. As with the EFA, a one-way ANOVA was conducted to assess for any order effects. The omnibus F test indicated that there were substantial differences in the scores due to order, $F(9, 730) = 2.12$, $p = .026$. Contrast analyses were conducted in the form of Tukey's HSD to determine where the differences were. Results suggest that order five was substantially different from orders three and six. It should be noted that there were over 90 comparisons resulting in 4 significant findings, which is within the

95% probability of chance. Point estimate reliabilities for each of the constructs were very good, with all reliabilities being over .80 and some reliabilities being over .95.

<Insert Table 6 Here>

PA. The IPAQ was used to assess levels of PA. The measure was scored according to the corresponding directions to produce metabolic equivalent values for walking, moderate PA, and vigorous PA. Unfortunately, the IPAQ had substantially higher levels of missing data than any of the self-regulation items. The scale scores had missing data of 5.41%, 10.81%, and 19.46% for walking, moderate PA, and vigorous PA respectively. Additionally, the scale scores where highly skewed and kurtotic (walking, skewness=8.321, kurtosis=131.916; moderate PA, skewness, 3.54, kurtosis = 18.008; vigorous PA, skewness = 24.413, kurtosis = 595.999). In order to correct for the non-normality a natural log transformation was performed which resulted in acceptable levels of skewness and kurtosis for walking and moderate PA (e.g., < 2.0) but resulted in unacceptable levels skewness and kurtosis for vigorous PA (skewness = -2.836, kurtosis = 6.221). The natural log transformed variables were used in subsequent analyses. The FIML function of M*plus* was used to handle missingness and the MLR estimator was used to handle non-normality of the data. The MLR estimator uses sandwich estimators to compute standard errors that are robust to non-normality.

Identifying Factors and Eliminating Items

Per the procedures outlined above, a series of EFA's and CFA's were conducted to identify the proper number of factors to retain and eliminate items that did not load on these factors. For each step of each analysis, fit indices, the number of factors retained, and the number of items used in the analysis, are presented in Table 7. The theoretical interpretability of the

factors was examined for each EFA analysis as well as the final model. The interpretations of these factors are presented in the discussion section. The results for each step were as follows:

<Insert Table 7 Here>

1) A 25-factor solution was fit using the EFA data and 58 items with loadings of less than 0.4 and were removed.

2) A 12-factor solution was fit using the EFA data and the items retained from Step 1 and 18 items with loadings less than 0.4 were removed.

3a) A scree plot was requested using the retained items from Step 2. The scree plot suggested a five-factor solution and is displayed in Figure 2. Using the items retained in Step 2 several factor solutions ranging from five to 12 were estimated. An eight-factor solution was chosen after comparing the theoretical interpretability of all eight-factor solutions. For the eight-factor solution, 22 items had loadings less than 0.4.

3b) Using the factor solution from Step 3a, a CFA model was fit with the CFA data. Items that did not lot at least 0.4 in the previous step were allowed to freely load on the eight factors in the CFA model. There were 12 items from the CFA analysis that had loadings less than 0.4.

4a) The items retained from Step 3b were used to conduct another set of EFA analyses using the EFA data. Factor solutions ranging from five to nine were requested. Again, based on the theoretical interpretability of the items, an eight-factor solution was determined to be the most interpretable. From the eight-factor solution, 14 items loaded less than 0.4.

4b) Using the factor solution from Step 4a, a CFA model was fit with the CFA data. Again, items were specified to load on the respective factors from the EFA analysis in Step 4a

and any items that loaded less than 0.4 were allowed to freely load on any of the eight factors. Results from this analysis revealed that five items loaded less than 0.4.

5a) Using the items retained from Step 4b, several EFA factor solutions were analyzed, ranging from five to nine factors. Their theoretical interpretability was examined and an eight-factor solution was determined to be the most interpretable. From the eight-factor solution, eight items had loadings of less than 0.4.

5b) Using the items from Step 5a and the procedures from step 4b, an eight factor CFA model was fit using the CFA data. The loadings from five variables in the analysis were less than 0.4.

5c) Using the items retained from Step 5b, several EFA factor solutions were analyzed, ranging from five to nine factors. Their theoretical interpretability was examined and an eight-factor solution was determined to be the most interpretable. From the eight-factor solution, nine items had loadings of less than 0.4.

5d) Using the items from Step 5b and the procedures from the steps using CFA, an eight-factor model was fit. The loadings from eight variables in this analysis were less than 0.4. After examining the items with loadings less than 0.4 in Steps 5c and 5d, it was determined that the items were not the same. That is, none of the items with loadings less than 0.4 in the EFA were the same as items with loadings less than 0.4 in the CFA. The differences in terms of the item loadings may be due to sampling error. The item content of the variables with loadings less than 0.4 from both steps was examined and items were dropped based on the theoretical interpretability with the corresponding factor, resulting in the dropping of nine items. A CFA model was fit using the 96 retained items and the results from this model indicated that all but four variables had loadings greater than 0.3. Additionally, the RMSEA from this model was

0.073, indicating inadequate fit. Using this CFA model, the modification indices and EPC values were examine to determine if model fit could be improve by correlating error terms.

Extremely large values for the modification indices and standardized EPC values were examined (e.g., values over 100 for modification indices and values greater than 0.4) and results indicated a number of items that if correlated, would improve the fit of the model. While the cut-off values for the modification indices and EPC values are arbitrary, they are rather conservative. Raykov and Marcoulides (2010) suggest using a modification index of 2.00 or higher as suggestive of a significant modification index. However, they also note that modification indices are sensitive to sample size. There are no recommended cut-off values for EPC values. Additionally, items with high modification indices and EPC values were only chosen if they made theoretical sense. In this case, items that came from the same measure and met the cut-off values were chosen because items from the same measure also had the same instructions and similar wording. From a theoretical perspective, these items should have common residual variance. These items and their correlations are presented in Table 8.

<Insert Table 8 Here>

6) Using the eight-factor, 96-item model from Step 5d, a CFA model was fit with the recommended correlated error terms. Results from the CFA show a dramatically improved fit (RMSEA = 0.049, TLI = 0.848, and CFI = 0.854). The model was below the cutoff value of .05 for the RMSEA but below the 0.95 cutoff for the TLI and CFI as well. The loadings and corresponding standard errors and significance values for this model are presented in Table 9. The loadings for the model ranged from 0.331 to 0.886 with the average loading being about 0.65. The correlations between the factors are presented in Table 10. The correlations ranged from 0.249 to 0.884 with many of the correlations being in the moderate to large range based on

Cohen's classifications (Cohen, 1988). For all but one factor, the reliabilities were all over .8 indicating good reliability. Factor 5 had a reliability of 0.588.

While factor five had been a stable and consistent factor across the previous steps, an examination of the item content revealed the factor to be uninterpretable. Moreover, three of the four items from step 5d with loadings less than 0.4 were included on this factor. Removing these items would result in a factor with less than three items, which, if measured on its own, would result in an unidentified model. This factor was included in all previous steps for completeness, but was removed from the final step (Step 8) of analyses because of the lack of interpretability. The CFA of the seven factor model resulted is a slightly bettering fitting model (RMSEA = 0.049, TLI = 0.860, and CFI = 0.866).

<Insert Table 9 Here>

<Insert Table 10 Here>

7) Given the high correlations between the factors, this may be indicative of a higher order factor. A separate CFA model was run with the seven factors from Step 6 as the indicators for a single higher-order variable. The higher-order model indicated a slightly worse fit than the model without the higher order factor (RMSEA = .052, TLI = .828, CFI = .834), and a χ^2 difference test comparing the first-order model to the higher-order model showed a significant difference in the two models, suggesting there is not a single higher-order factor, χ^2 (450, N = 740) = 2541.047, $p < .001$).

8) Using the seven-factor model from Step 6, the convergent validity of the seven-factor model was assessed by regressing a latent PA variable onto the seven latent self-regulation variables. The measurement model (i.e., a model with each latent variable represented by the constituent indicators and where all the latent variables are correlated) indicated adequate fit

(RMSEA = .045, TLI = .857, CFI = .863). Results from the structural model (i.e., the regression of PA on the seven self-regulation factors) indicated that this model did not fit worse than the measurement (RMSEA = .044, TLI = .863, CFI = .868), which suggests the structural model better represents the data because it provides a clearer interpretation of the data. The completely standardized loadings and corresponding standard errors and *p* values for this model are presented in Table 11. Of the seven factors included in the structural model, two factors significantly predicted PA; factor 3 (Goal Setting/Goal Planning) and factor 6 (Goal Setting/Outcome Expectancy). The completely standardized loadings for these factors were 0.861 and -0.261 respectively. Additionally, the structural model predicted 48% of the variance in PA.

<Insert Table 11 Here>

In order to compare the convergent validity of the of the measure developed in this study to the individual measures, scale scores for each of the individual measures were created by averaging the items of each measure together, and then the latent PA variable was regressed on to each of the nine scale scores. The standardized beta coefficients and corresponding standard errors and *p* values for this model are presented in Table 12. Results from this analysis indicate that three of the nine measures significantly predicted PA; specifically, the measure by Dishman et al. (2002), the measure by Mullan et al. (1997), and the HBS (Anderson et al., 2006) have standardized betas of 0.226, 0.262, and 0.253 respectively. Additionally, the model with the nine measures predicted 53% of the variance in PA.

<Insert Table 12 Here>

Final and Individual EFA's

The final communalities, eigenvalues, and loadings for the final EFA model in step 5c are presented in tables 13, 14, and 15 respectively. Additionally, the correlations between the factors and the reliabilities for each factor are presented in Table 16. The reliabilities of the factors were all over .8 indicating good reliability. Exploratory factor analyses were run on all of the individual measures as well. Fit indices for a range of factor solutions for each measure are presented in Table 17. Scree plots from these analyses suggest a factor structure different than those hypothesized factor structures of the original articles. Additionally fit indices also indicated factor structures different than those suggested in the original articles of the measures. A comprehensive comparison of the original measures to the EFA analyses conducted here is beyond the scope of this study; however, a cursory examination of these EFA analyses suggest that alternative factor structures and item loadings may provide a better fitting model for some of the individual measures.

<Insert Table 13 Here>

<Insert Table 14 Here>

<Insert Table 15 Here>

<Insert Table 16 Here>

<Insert Table 17 Here>

Final and Individual CFA's

In addition to the overall CFA, individual CFA models were run for each of the individual measures as they were specified in their original articles. Comparing the fit indices in Table 17 to the ones reported from the original articles (shown in Table 2) shows that the fit indices for the measures administered in this study indicate worse fit than those reported in the original articles. In particular, the RMSEA's were substantially larger in this study than the

original articles, indicating worse fit. It should be noted though that only five of the nine measures reported any fit indices.

<Insert Table 18 Here>

Discussion

The goal of the analytical portion of this study was to create a statistically valid, reliable, and parsimonious measure of self-regulation from nine different existing measures of self-regulation. The remainder of the paper will focus on examining and interpreting the factor structure obtained from the exploratory and confirmatory factor analyses in the context of the theories described above.

Interpretation of Factors

As mentioned above, for the EFA's in Steps 3a, 4a, 5a, and 5c, a range of factor solutions were run and each factor solution at each step was assessed for theoretical interpretability. This process involved several steps. This first step was organizing each factor solution into separate databases and color coding the items based on the original self-regulation construct they were hypothesized to measure. The items and the item content were examined to determine if there was any theoretical overlap and to determine if factors were combined or split as a result of the number of factors requested in the EFA analysis. Lastly, each factor solution was examined to determine if it was theoretically interpretable. For example, some factors had items that were from different measures and were hypothesized to be measuring disparate constructs. Below is a description of the general methods used in interpreting the factors solutions at each step. Next, the final eight-factor model from Step 6 is discussed and each factor is interpreted based on the theories described above. Lastly, the relationship between the items and the factors they loaded on are discussed.

In Step 3a, factor solutions ranging from five to twelve were examined. For the ten- through twelve-factor solutions, factors that did not have a clear theoretical interpretability began to form. That is, factors existing in previous factor solutions did not generally separate for these

solutions to form new factors so much as items that did not load in previous solutions began to load on to new factors. For the five through eight-factor solutions, factors began to combine in ways that made them less interpretable. A nine-factor solution was determined to be the most interpretable, but there was one consistent factor across the solutions that was not interpretable and was removed. It should be noted that while an eight-factor solution was the most interpretable, several factors had items from theoretically distinct constructs.

The interpretations for the remaining EFA's were all very similar to that in Step 3a. In the remaining steps, the factor solutions ranged from five to nine and the same patterns of loadings emerged across the steps. Specifically, the items that loaded onto the factors changed very little from analysis to analysis. The main difference between the factor structures at each step was that in the latter steps, there were fewer items on each construct. As with Step 3a, a nine-factor solution resulted in the addition of a new factor that had no interpretability and in factor solutions less than eight, theoretically distinct factors began to combine with one or more factors. Again, even in the eight-factor solution, the interpretation of each factor was not entirely clear; several theoretically distinct constructs loaded onto the same factor and when these factors combined in factor solutions less than eight, the factors became even less interpretable.

In the final CFA conducted in Step 6, eight factors were fit in the model. Appendix B contains the final list of 96 items from Step 6. The first factor contained 17 items that measured several distinct proposed theoretical constructs, both in terms of their original measure and in terms of self-regulation as a whole. Specifically, factor one measured goal commitment (six items), self-efficacy (four items), positive affect (three items), self-monitoring (two items), and planning (two items). All of the items came from the GAPI and the GSAB. The items measuring goal commitment and self-efficacy came from the GAPI. Based on the item content, it appeared

that both of these constructs were measuring similar facets of self-regulation. For example, an item that measured commitment was, “Whatever happens, I will not give up on this goal” which seemed very similar to the self-efficacy item, “I have a clear idea of what it takes to achieve this goal”. The goal commitment items seem to align with Bandura’s conceptualization of self-regulation self-efficacy (as do the self-efficacy items).

Items measuring self-monitoring and planning came from the GSAB and there was an overlap of items measuring positive affect between the two measures. These constructs appear to be theoretically distinct and a reason why these items load on the same factor is not overtly apparent. It should be noted that almost all of the questions on this factor are similarly worded, which may be a reason why they loaded on the same factor. Based on the interpretation of this factor, it is subsequently referred to as Self-Regulation Self-Efficacy.

Self-regulation self-efficacy is explicitly mentioned in SCT and self-efficacy is mentioned in both D. Ford’s (1987) and M. Ford’s (1992) theories. While self-efficacy is not explicitly mentioned in SDT, competency is thought to be a component that can produce intrinsic motivation. As noted in MST and SCT, often self-regulation self-efficacy requires some sort of mastery experience to occur in order for it to develop. That is, a person has to engage in the regulatory behaviors and achieve some desired goal before their sense of self-efficacy can be developed. This would indicate that self-regulation self-efficacy is important when a person is beginning his or her goal-directed behaviors. As one progresses through the process of self-regulation though, self-regulation self-efficacy may not be as important.

Factor two was made up of seven items from three different measures (the GAPI, the GSAB, and the measure from Mullan et al.,1997), which mostly seemed to measure some aspect of negative affect. The proposed constructs that these items originally were supposed to measure

included, negative affect (four items), introjected regulation (two items), and self-monitoring (one item). Items measuring negative affect and introjected regulation assessed the participant's negative emotions as they related to not achieving PA goals. The one self-monitoring item was "I am on the lookout for potential obstacles that might interfere with my progress on this goal". Similar to the negative affect and introjected regulation questions, this item deals with not achieving a goal, which may explain why it loaded with the other items. Based on the items that loaded on this factor, factor two will be referred to as Negative Affect.

Based on D. Ford's (1987) theory and SDT, negative affect could serve to motivate regulatory behaviors so as to avoid a negative outcome or emotion. This is the hallmark sign of introjected regulation in SDT. D. Ford also posits that emotions provide motivation to achieve goals and feedback regarding one's process towards said goals. Emotions are also mentioned in MST and the conceptualization of emotions within the context of regulation are similar to those proposed by D. Ford.

Factor three is the largest factor with 34 items measuring six different proposed constructs from five different measures (the HBS, the Mullan et al., 1997 article, the Rovniak et al., 2002 article, the Petosa, 1993 article, and the Sniehotta et al., 2005 article). These constructs include planning (15 items), goal setting (eight items), self-monitoring (three items), identified regulation (one item), intrinsic motivation (three items), and intentions (four items). As with factor one, the interpretation of this factor is not straightforward. A majority of the items appear to be measuring either goal setting or goal planning. In terms of the process of self-regulation, goal setting and goal planning may not have a clearly defined point at which one stops and one begins. For example, if one were to set a goal of increasing PA, he or she would subsequently have to set more proximal goals such as "I'm going to go jogging at 6:30AM, five days a week".

As the goal setting becomes more specific, planning begins to become intertwined in the process. In order to understand the temporal sequence of these processes, researchers will have to have baseline measurement of the participants PA levels and more than one administration of this measure will be necessary. Intentions seem to be closely related to goal setting. That is, a question asking if you intend to exercise may be indistinguishable to respondents from ones asking if you have set a goal to exercise.

Both identified regulation and intrinsic motivation are components of SDT. It is theorized that identified regulation is the second most self-determined form of external regulation, and the more self-determined a behavior is, the more likely a person is to engage in it. Since these items load with the goal setting and goal planning items, this may suggest that those individuals who are able to set and plan goals may be more self-determined. However, the fact that the items loaded together suggests that they are part of the same construct and not necessarily co-occurring processes. Based on the interpretation of factor three, it will subsequently be referred to as Goal Setting/Goal Planning.

Factor four is comprised of six items assessing three different proposed constructs from three different measures (the HBS, the GAPI, and Rovniak et al., 2002). An examination of the item content reveals that all of the items seem to be measuring goal communication. For example, all of the questions pertain to talking with another person about one's goals. Goal communication is not part of any of the previously mentioned theories of self-regulation; however, social support is part of SCT. One could argue that by communicating one's goals to others, that person is tacitly expecting some support from that person. Several studies have found that social support can increase PA through indirect means (Anderson, et al., 2006; Plotnikoff,

Lippke, Courneya, Birkett, & Sigal, 2008; Resnick, Orwig, Magaziner, & Wynne, 2002), often impacting self-efficacy, goal setting, or outcome expectancy, which affects PA.

As noted in Step 6 of the analyses, Factor 5 was determined to be uninterpretable. It is made up of five items from two different measures. The constructs that these items are hypothesized to measure are self-monitoring (one item), self-criticism (two items), reinforcement strategy (one item), and positive affect (one item). Based on the theories from the original measures, no common theoretical underpinnings of the constructs could be identified, so this factor was removed from the final concurrent validity analysis.

Factor six contains nine items from two different measures; one item from the Dishman et al. (2005) article and eight from the Petosa (1993) article. Since the Petosa article did not indicate which questions measured which components, the item content was examined in order to interpret the factor. Of the nine items from this factor, five appear to measure goal setting, and four appear to measure outcome expectancies. An example of an item that measured goal setting is, “I establish short term goals (daily or weekly) related to how often I exercise”. An example of an item measuring outcome expectancies would be, “I remind myself of how exercise makes me look better (e.g., lose weight, tone body)”. Goal setting is part of each of the four theories discussed previously and is the integral first step in the process of self-regulation. Outcome expectancy is a feedforward mechanism in SCT, but is usually considered a separate construct that influences self-regulation (c.f. Anderson et al., 2006; Rovniack et al., 2002). Outcome expectancies are also part of D. Ford’ (1987) theory and operate within the direction function. Outcome expectancies help to determine what goals need to be set in order to achieve a desired outcome. Goal setting is also a component of the direction function which may indicate why these two constructs loaded on the same factor, despite the fact that most of the items come from

Petosa's measure. Based on the interpretation of the items within this factor, factor six will be referred to as Goal Setting/Outcome Expectancy.

Factor seven is made up of six items, all from Petosa's (1993) measure. Based on the interpretation of the item content from this factor, there appear to be two proposed constructs being measured. The first is self-monitoring, as measured by four items. An example of a self-monitoring item would be, "I recorded my exercise activities in a written record". The second construct is relapse prevention and is measured by two items. An example of relapse prevention is, "I wrote down barriers which influence my ability to exercise". The reason that these two constructs loaded together on this factor may be because each of the items assess whether the respondent writes down or records some aspect of their PA behaviors. Regardless of what is being recorded, it would seem that simple act of recording would involve one's ability to self-monitor his or her behavior. Self-monitoring is an integral part of SCT. In addition to allowing the individual to track his or her progress toward a goal, self-monitoring simultaneously provides feedback that allows the individual to make changes to his or her behavior in order to better achieve his or her goal. In addition to SCT, self-monitoring and feedback are explicit components of D. Ford's (1987) theory, M. Ford's (1992) theory, and SDT. In each of these theories, self-monitoring/feedback serve the same function as outlined in SCT. An alternative explanation for why these items load together is that they come from the same measure. Items from the same measure usually have similar wording and they all have the same directions administered to each item. This may cause them to load together, negating any theoretical interpretation. Based on the interpretation of this factor, it will subsequently be referred to as Self-Monitoring.

Lastly, factor eight contained 10 items all from the Sniehotta et al. (2005) measure. The items from this factor were all items from the action planning and the coping planning constructs from the original measure. Items from this measure were derived from Gollwittzer's (1993) conceptualization of implementation intentions. Implementation intentions are supposed to bridge the gap between goal-setting/intentions and the actual behavior. Planning is also a part of the control function in D. Ford's (1987) theory and is included as construct in each of the SCT measures. It should be noted however that the wording of each of these items was very similar. Each item began with "I have made a detailed plan…" which may explain why only items from one measure loaded onto this factor. Based on the interpretation of this factor, it will subsequently be referred to as Goal Planning.

Overall, it would appear that the factors derived from the EFA's and CFA's do map on to existing theories of self-regulation lending validity to the assertion that these measures are assessing several hypothesized constructs of self-regulation. However, for several factors, the theoretical interpretations were not entirely clear. The Self-Regulation Self-Efficacy, Goal Setting/Goal Planning, and Goal Setting/Outcome Expectancy factors contained items that measured more than one construct on each factor. Another difficulty that developed with respect to the interpretability of the factors is that different facets of self-regulation loaded onto multiple factors. For example, items assessing self-monitoring loaded onto five different factors. Additionally, the Goal Setting/Goal Planning factor (factor 3) contains items from six different constructs and several other factors emerged as measuring the constructs contained in factor three, including Self-Monitoring (factor 7), Goal Setting (factor 6), and Goal Planning (factor 8).

While the lack of interpretability for several of these factors does detract from our ability to understand the processes of self-regulation, there does appear to be an overlap in terms of the constructs being measured across theories and measures.

Predicting PA

Results of the Step 8 SEM analysis, regressing PA on to the seven factors of self-regulation, revealed that two factors predicted PA; Goal Setting/Goal Planning (factor 3) and Goal Setting/Outcome Expectancy (factor 6). The overall model indicated improved fit over both the CFA of the original eight factors and the measurement model with the latent PA variable. As mentioned above, because of the difficulty in relating these factors back to original theories (in particular the Goal Setting/Goal Planning factor) understanding the implication for these findings is difficult. For example, because six theoretically distinct constructs were measured in the Goal Setting/Goal Planning factor, no claims can be regarding which of these constructs had the most influence on PA. Despite the lack of interpretability, this factor was a strong predictor of PA.

Interestingly, the Goal Setting/Outcome Expectancy factor negatively predicted PA, meaning that as values on this factor increased, PA levels decreased. This finding is contrary to what is hypothesized by the theories that utilize goal setting and outcome expectancies. Again, because of the multiple constructs that are part of this factor, an interpretation of this finding is difficult. This finding is perplexing because goal setting was one of the constructs in the Goal Setting/Goal Planning factor that positively predicted PA behaviors, which suggest the two factors are measuring different constructs. With regard to outcome expectancies, previous research has found a negative relationship between PA and outcome expectancies, despite this relationship being contrary to the one posited by SCT. Specifically, Anderson et al. (2006) found that positive outcome expectancies had a negative direct relationship with PA and negative

outcome expectancies had a negative indirect relationship with PA that was mediated by self-regulation. An examination of the item content for this factor revealed that one item could be considered a measure of negative outcome expectancies while the other three items appeared to measure positive outcome expectancies. None of the measures included in this study explicitly measured different types of outcome expectancies and because two constructs are being measured by this factor, so no theoretical explanation for this relationship can be offered.

As a final means of comparing the measure and corresponding factors developed in this study to the original measure, a regression of PA on the scale scores for the original measures was conducted. The results showed that the HBS, the Mullan et al. (2007) measure, and the Dishman et al. (2002) measure were the significant predictors of PA. Interestingly, items from both the HBS and the Mullan et al. (2007) were included in the measure developed in this study, but no items were used from the Dishman et al., (2002) measure. Both the Dishman et al., (2002) measure and the HBS created by Anderson et al. (2006) were based on SCT, but neither of these articles explain how the items in the measures relate to the specific components of SCT. An examination of the item content from these measures reveals that both measures assess goal setting and goal planning and both of these constructs are contained in the Goal Setting/Goal Planning factor from the current study. The Mullan et al. measure was developed from SDT and was hypothesized to measure several OIT components. Because the measure was multi-dimensional and a scale score was used to predict PA, it is difficult to know which constructs were influential in predicting PA. An examination of the item content revealed that most of the items did not overlap with any of the other two significant predictors of PA.

Additionally, each of the significant predictors from the scale score model, had coefficients of about 0.25, which was substantially less than the 0.861 coefficient for the Goal

Setting/Goal Planning factor. This would suggest that the Goal Setting/Goal Planning factor is a better predictor of PA than the original measures. However, it should be noted that the model with the individual measures as predictors accounted for slightly more variance in PA than did the factors developed from this study.

Limitations

There are a number of limitations that could have influenced the findings of the current study. First, the methods used to eliminate items and retain factors have not been empirically validated. There are likely several other methods that could have been used to eliminate items. Without comparing these methods against one another, it is impossible to say which method is "better". Alternative methods may or may not have resulted in fewer item and/or factors with clearer interpretations. The lack of interpretability of these items is another limitation to this study. Without a clear interpretation of each of the factors identified in this study, understanding the processes of self-regulation, particularly in the context of predicting PA behaviors, becomes very difficult.

While the sample size was large for both the EFA and CFA, some researchers have stated that a 10 person per one item rule of thumb be used when conducting factor analyses. However, MacCallum, Widaman, Zhang and Hong (1999) state that this is a misconception among researchers and demonstrated that the sample size is dependent upon overdetermination (i.e., the ratio of items to factors) and the communalities of the items. Factor determinacies for this study were all over .9 indicating high factor determinacy and communalities ranged from .315 to .887.

Another limitation of the study was that many of the measures used were developed from SCT theory only. This can be viewed as a limitation in that it limited the possible number of constructs that could be developed. However, having measures that were derived from the same

theory helped to find overlap between and among the measures. Third, some of the original measures used to develop the new measure were originally developed for children. The measures by Dishman et al. (2005) and Dishman et al. (2002) were initially developed and tested on adolescent females. Since only one item was used from either of the measures, this could suggest that the self-regulation constructs vary as a function of age and/or gender. It may have been more prudent to identify measures that had been validated for the population in this study.

Lastly, the lack of reliability, the non-normality, and the large amount of missing data in the PA measure were limitations to the current study. While attempts were made to address this issuing by using FIML for missing data and using the MLR estimator to address the non-normality, there is no way to tell whether the estimates from the SEM analyses were biased. It would have improved the study to include more demographic, or other types of questions that would predict the missingness for the IPAQ.

Future Directions

The purpose of this study was to identify overlapping factors among existing measures of self-regulation for physical activity and create a new measure by reducing the number of items through iterative exploratory and confirmatory factor analyses and confirming the factor solution through CFA. Unfortunately, due to the lack of interpretability of several of the factors in the final model, the developed measure cannot claim to be an accurate and valid measure of self-regulation. Additionally, because of the lack of interpretability of the factors identified in this study, few definitive claims can be made regarding what the overlapping constructs of self-regulation are and how they influence PA. Below is a discussion of several possible future directions that have the potential to diminish some of the ambiguity identified in this study.

First, and most importantly, more psychometric research needs to be done in terms of parsing apart the constructs that did not have clear interpretations. Specifically, the Self-Regulation Self-Efficacy factor, the Goal Setting/Goal Planning factor, and the Goal Setting/Outcome Expectancy factor, contained multiple constructs that inhibited their interpretation.

There are likely three possible reasons for the lack of interpretability. The first is the method used to eliminate items. As mentioned above, there is no empirical research on how best to eliminate items from EFA and CFA analyses. Future research should focus on identifying and comparing methods of eliminating items. An alternative method that may provide more interpretable factors would be to use the deductive method described above. The second relates to the method used to assess the constructs. The measures were administered cross-sectionally, however, a number of theories have posited that the mechanisms of self-regulation occur in a temporal sequence (e.g., goal setting first, goal planning second, and goal monitoring/maintenance last). Based on these theories, it is possible that the setting, planning, and monitoring of goals could not be distinguished in this study because individuals did not move through the self-regulation process.

The last reason that may explain the lack of interpretation of the factors is that the measures used in this study do not accurately measure self-regulation. As mentioned above, there is only one measure where an EFA was previously conducted and only five measures where a CFA was previously conducted. It may be that several of these included measures are poor representations of the self-regulation or that more initial psychometric research needs to be conducted to determine the validity of these measures. Future research that attempts to use the

methodology outlined in this study for comparing measures may be better off only including measures that have been rigorously examined.

Distinguishing constructs that are interrelated requires methodological and statistical procedures more complicated than simply administering a measure online. Future studies should try to distinguish these overlapping constructs through a longitudinal design. Researchers can identify sedentary individuals who desire to change their PA behaviors and then obtain multiple measurements, across time, of the identified self-regulation constructs as they work towards their PA goals. Additionally, latent class analysis can be used to assess for any individual differences that may manifest across the different stages. With an already established set of clearly defined factors, factor scores can be examined to see if a meaningful pattern emerges across time points. For example, at the beginning stages of behavior change, individuals may have high factor scores on goal setting, but not on goal planning. As they work toward and achieve their goals, individuals at later time points may have low factors scores on goal setting and high scores on goal planning. Utilizing a longitudinal design and latent class analysis would allow researchers to begin to understand the dynamic process of self-regulation that was not assessed in this study.

This study has demonstrated that the theory of self-regulation for PA is multifaceted and complex. Future research should further elucidate which constructs are relevant to the process of self-regulation and evaluate which constructs mediate PA behaviors. Moreover, self-regulation is often one of many constructs contained within a PA behavior change theory (such as SCT). This adds a level of complexity to understanding PA behaviors because, as this and other studies have demonstrated, there are enough constructs that comprise self-regulation for it to constitute its own theory of behavior change. It is important to parse apart how these constructs differ from other important constructs like self-efficacy and outcome expectancy, and how these constructs

affect each other. Future research should begin hypothesizing behavior change models with these constructs and testing them in randomized control trials. A word of caution should be given in regard to the complexity of behavior change theories. As a theory becomes more complex, arguably its utility becomes less useful. From a statistical perspective, the more complex a model becomes, the more likely one is to unknowingly make a misspecification error that biases results in unpredictable ways. From a theoretical perspective, a theory that is so complex that it ultimately suggests "everything affects everything" is un-falsifiable and therefore un-testable.

Determining the validity of a measure takes time and replication. More work needs to be done in terms of developing and validating measures of self-regulation. This includes assessing the convergent and divergent validities of these measures. Given the overlap among theories and among other conceptually distinct but related factors, assessing convergent and divergent validity is an important step in developing a comprehensive model of PA behavior change.

The final CFA model for this study only met the cut-off value for one fit index. This was likely due to the large number of items in the final model. Fit could be improved by using parceling (Little, Cunningham, Shahar, & Widaman, 2002). Parceling involves the combination of items to form a smaller subset of indicators for a known latent factor. By reducing the number of variables through parceling, one can improve the fit of the model. Parceling was not used in the current study because of missing data. Currently there is no research on creating parcels with missing data; however, parcels are essentially scale scores and there is research on creating scale scores with missing data using multiple imputation (Gottschall, West & Enders, 2012). Findings from Gottschall et al. suggest that while both methods produced estimates with negligible bias, imputing missing values at the item level, rather than the scale level, produced more efficient estimates of the scale scores. Assuming the factor structures are correct, future research should

utilize item-level imputation methods to create parcels from some of the factors with many items. Given the discussion above though, many factors may represent multiple constructs.

Conclusions

This study has elucidated some of the factors involved in self-regulatory processes and outlined a research agenda for further developing the theory and measurement of self-regulation. The factors identified from the analyses were described in the context of several self-regulation theories and while a clear interpretation of several factors was not evident, the current study has begun to address some of the theoretical and measurement issues related to the self-regulation of PA. Understanding PA behavior change is a complex process, both from a theoretical and a methodological perspective. Continuing to test and revise the theories of behavior change is paramount in order to advance our knowledge, understanding, and ultimately, the science of PA research.

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Table 1.

Measures to be examined in factor analyses with the theoretical orientations of the intervention and the type of self-regulation measured as well as corresponding sample items.

Author	Theory used for intervention	Theory used for self-regulation measure	Sample Items
Dishman et al., 2002	SCT	SCT (Bandura, 1991)	I think about the benefits I will get from being physically active. When I get off track with my physical activity plans, I tell myself I can start again and get right back on track. I set goals to do physical activity.
Dishman et al., 2005	SCT	SCT (Bandura, 1991)	I do things to make physical activity more enjoyable. I try different kinds of physical activity so that I have more options to choose from. I make backup plans to be sure I get my physical activity.
Anderson et al., 2006	SCT	SCT (Bandura, 2005)	In the past month how often did you: Set aside time each day to walk or do other exercise? Keep track of how much you enjoy your walking or other exercise? Keep or make a new plan based on how well you were doing with your walking or other exercise?
Karoly & Ruehlman, 1996	N/A	Transactional model of adaptive control systems (D. Ford, 1987)	I possess the necessary skills to attain this goal. Working on this goal makes me feel somewhat panicky I tend to notice my successes while working toward this goal

Maes, Pomaki, Joekes, Boersma, Gebhardt, & Huisman, 2001	N/A	Motivational Systems Theory (M. Ford, 1992)	It is difficult for me to achieve this goal
			My attainment of this goal depends on external factors
			Whatever happens, I will not give up this goal
Mullan, Markland, & Ingeldew, 1997	N/A	SDT (Deci & Ryan, 1985)	I exercise because other people say I should
			I feel guilty when I don't exercise
			I exercise because it's fun
Petosa, 1993	SCT	SCT (Bandura, 1986; Kanfer & Gaelick, 1986; Leventhal, Zimmerman, & Gutmann, 1984)	I established short term goals (daily or weekly) related to how often I exercise
			I recorded my exercise activities in a written record
			I rewarded myself for exercising (e.g. snack, watch TV, movies, buy gift, etc.)
Rovniack, Anderson, Winett, & Stephens, 2002	SCT	SCT (Bandura, 1991)	I often set exercise goals
			I schedule all events in my life around my exercise routine
			If I do not reach an exercise goal, I analyze what went wrong
Sniehotta, Schwarzer, Sholze, & Shuz, 2005	SCT	Implementation Intentions (Gollwitzer, 1999)	I intend to work up a sweat regularly
			I have made a detailed plan regarding how to exercise
			I have made a detailed plan regarding when I have to pay extra attention to prevent lapses

Table 2.
Psychometric information for the measures included in the factor analyses.

Author	Measure	Number of Questions	EFA		CFA		Reliability	
			Factors	Type of rotation	Factors	Fit indices	Test retest	Cronbach's Alpha
Anderson et al., 2006 †	Health Belief Survey	14			*			.83[1]
Dishman, Hales, Sallis, Saunders, Dunn, Bedimo-Rung, & Ring, 2002		6			Cognitive Strategies	CFI = .957 NNFI = 0.919 RMSEA = 0.067		.657
					Behavioral Strategies	CFI = .926 NNFI = .860 RMSEA = .102		.712
Dishman et al., 2005		8			*	CFI = .98 NNFI = .97 RMSEA = .04		.83
Karoly & Ruehlman, 1996	GSAB	36			Value	CFI = .95 (average)		.85
					Self-Efficacy			.80
					Social Comparison			.82
					Self-Monitoring			.67
					Planning			.70

Maes, Pomaki, Joekes, Boersma, Gebhardt, & Huisman, 2001 †	GAPI	50 (only 38 were used for the current study)	Self-Criticism	.84
			Self-Reward	.82
			Positive Arousal	.88
			Negative Arousal	.65
			Feedback/ Attainability	.71
			External Control	.68
			Goal Commitment	.86
			Goal Alignment	.81
			Goal Conflict	.77
			Goal Efficacy	.80
			Goal Outcome Expectancies	.74
			Goal-Related Positive Emotions	.81
			Goal-Related Negative Emotions	0.82
			Goal Communicative Actions	0.84
			Goal Support	0.86
			Goal Pressure	0.81

			Goal Pressure		0.81
Mullan, Markland, & Ingeldew, 1997	15		External Regulation	χ^2 = 184.16	.789
				RMSEA = .07	
			Introjected Regulation		.763
				GFI= .90	
			Identified Regulation	NNFI=.91	.786
			Intrinsic Regulation		.903
Petosa, 1994 †	51	Self-Monitoring		.92	.79
		Goal-Setting			.87
		Behavioral Cues			--
		Social Support			.88
		Environmental Aides			88
		Modeling			--
		Reinforcement Contingencies			.62
		Compatible Habits			--
		Time-Management			.76
		Perceived Barriers			--
		Relapse			

			Prevention					.77
			Behavioral Contracting					
Rovniack, Anderson, Winett, & Stephens, 2002 †	Exercise Goal-Setting Scale (EGS)	10			*		.87	.89
	Exercise Planning and Scheduling Scale (EPS)	10			*		.89	.87
Sniehotta, Schwarzer, Sholze, & Shuz, 2005		16	Behavioral Intentions	Varimax (PCA)	Behavioral Intentions	χ^2=267.52		.88
			Action Planning		Action Planning	NFI=.94		.94
			Coping Planning		Coping Planning	TLI=.96		.91

Note: * = Only one factor; † = No factor analysis performed

Table 3.

EFA participant demographic information.

Demographic Variable		*n*	Percentage
Gender			
	Men	229	30.53%
	Women	521	69.47%
Ethnicity			
	White	591	78.80%
	Asian	72	9.60%
	African American	23	3.07%
	Hispanic	23	3.07%
	Other	30	4.00%
Age			
	18	195	26.00%
	19	212	28.27%
	20	161	21.47%
	21	113	15.07%
	22	45	6.00%
	>22	24	3.08%

Table 4.

CFA participant demographic information.

Demographic Variable		*n*	Percentage
Gender			
	Men	244	32.58%
	Women	495	66.09%
Ethnicity			
	White	575	77.60%
	Asian	74	9.99%
	African American	26	3.51%
	Hispanic	21	2.83%
	Other	45	6.07%
Age			
	18	175	23.33%
	19	222	29.60%
	20	160	21.33%
	21	113	15.07%
	22	44	5.87%
	>22	36	4.80%

Table 5.

EFA descriptive statistics.

Variable	Percent Missing	Mean	Std. Dev.	Skew	Kurtosis
SNIE1	0.67	3.240	0.766	-0.902	0.647
SNIE2	0.67	3.207	0.767	-0.815	0.438
SNIE3	1.20	3.286	0.705	-0.905	1.074
SNIE4	1.20	3.354	0.722	-1.033	1.007
SNIE5	0.67	2.554	0.726	0.253	-0.358
SNIE6	1.20	2.642	0.842	-0.391	-0.391
SNIE7	0.93	2.381	0.880	0.222	-0.636
SNIE8	0.80	2.481	0.907	0.083	-0.783
SNIE9	0.67	2.526	0.910	0.003	-0.799
SNIE10	1.33	2.596	0.897	-0.154	-0.723
SNIE11	1.07	2.220	0.889	0.318	-0.620
SNIE12	1.47	2.103	0.783	0.411	-0.133
SNIE13	1.07	2.158	0.776	0.273	-0.307
SNIE14	0.80	2.167	0.771	0.305	-0.218
SNIE15	0.67	2.345	0.807	-0.043	-0.596
SNIE16	1.20	2.232	0.778	0.088	-0.513
DISHB1	1.20	3.621	0.946	-0.406	-0.055
DISHB2	1.47	4.127	0.865	-0.787	0.195
DISHB3	1.60	3.875	0.948	-0.609	-0.065
DISHB4	1.73	3.769	0.983	-0.608	0.067
DISHB5	1.87	3.557	1.004	-0.526	-0.090
DISHB6	1.33	3.304	1.038	-0.022	-0.693
DISHB7	1.20	3.567	1.029	-0.465	-0.246
DISHB8	1.20	2.784	1.105	0.265	-0.621
DISHA1	1.20	4.116	0.876	-0.913	0.787
DISHA2	1.33	3.809	0.972	-0.619	0.050
DISHA3	1.07	3.608	0.993	-0.559	-0.065
DISHA4	1.20	3.332	1.036	-0.112	-0.562

DISHA5	1.47	3.652	0.989	-0.472	-0.167
DISHA6	1.07	2.844	1.117	0.200	-0.608
PETOSA1	1.07	3.709	1.059	-0.667	-0.108
PETOSA2	1.33	3.522	1.049	-0.507	-0.256
PETOSA3	1.07	2.084	1.297	0.979	-0.234
PETOSA4	1.73	1.962	1.223	1.131	0.223
PETOSA5	1.60	1.896	1.161	1.181	0.437
PETOSA6	1.60	3.676	1.121	-0.675	-0.184
PETOSA7	2.00	3.494	1.003	-0.392	-0.228
PETOSA8	2.53	3.550	1.029	-0.496	-0.104
PETOSA9	1.60	3.961	1.031	-0.900	0.315
PETOSA10	1.60	1.676	1.048	1.571	1.720
PETOSA11	1.47	2.790	1.274	-0.039	-1.129
PETOSA12	1.33	3.832	0.974	-0.722	0.291
PETOSA13	1.47	1.977	1.212	1.074	0.107
PETOSA14	2.27	3.020	1.230	-0.065	-0.867
PETOSA15	1.20	1.640	1.013	1.575	1.754
PETOSA16	1.60	2.413	1.210	0.400	-0.865
PETOSA17	1.33	2.670	1.168	0.066	-0.893
PETOSA18	1.07	1.841	1.074	1.173	0.569
PETOSA19	1.47	2.187	1.172	0.567	-0.739
PETOSA20	1.47	1.696	0.984	1.362	1.148
PETOSA21	1.60	2.615	1.098	0.072	-0.687
PETOSA22	2.00	2.107	1.115	0.612	-0.654
PETOSA23	2.00	2.042	1.148	0.721	-0.645
PETOSA24	1.60	1.858	1.131	1.147	0.345
PETOSA25	1.33	2.032	1.180	0.835	-0.376
PETOSA26	2.27	4.091	1.118	-1.135	0.494
PETOSA27	1.87	2.856	1.262	0.097	-0.984

PETOSA28	1.73	1.811	1.105	1.215	0.537
PETOSA29	2.40	2.366	1.183	0.431	-0.769
PETOSA30	2.27	3.746	1.195	-0.674	-0.450
PETOSA31	2.00	2.161	1.169	0.688	-0.532
PETOSA32	1.47	2.568	1.084	0.318	-0.426
PETOSA33	2.67	2.711	1.114	0.151	-0.574
PETOSA34	2.27	2.861	1.177	0.024	-0.753
PETOSA35	1.73	2.313	1.083	0.555	-0.287
PETOSA36	1.87	3.336	1.089	-0.295	-0.556
PETOSA37	1.47	3.767	1.016	-0.715	0.201
PETOSA38	1.60	3.824	0.967	-0.740	0.435
PETOSA39	2.13	4.007	1.015	-0.936	0.419
PETOSA40	1.60	3.688	1.156	-0.623	-0.427
PETOSA41	2.00	3.468	1.132	-0.419	-0.520
PETOSA42	1.47	2.124	1.248	0.835	-0.399
PETOSA43	2.27	2.566	1.208	0.282	-0.819
PETOSA44	1.07	2.373	1.071	0.442	-0.368
PETOSA45	2.00	2.725	1.029	-0.018	-0.474
PETOSA46	1.87	2.761	1.068	-0.043	-0.567
PETOSA47	1.47	1.716	1.019	1.310	0.827
PETOSA48	2.00	1.684	1.006	1.439	1.312
PETOSA49	1.33	1.755	0.982	1.214	0.788
PETOSA50	1.73	2.380	1.141	0.373	-0.773
PETOSA51	1.20	2.499	1.159	0.304	-0.741
ROV1	1.33	3.457	1.145	-0.339	-0.623
ROV2	1.60	3.125	1.232	-0.124	-0.927
ROV3	1.60	2.680	1.256	0.269	-0.927
ROV4	1.73	3.368	1.155	-0.361	-0.535
ROV5	1.87	2.871	1.139	0.005	-0.723

ROV6	1.73	2.879	1.191	0.103	-0.869
ROV7	2.00	2.702	1.171	0.273	-0.721
ROV8	2.27	3.149	1.128	-0.225	-0.617
ROV9	2.00	2.784	1.183	0.083	-0.834
ROV10	1.47	2.402	1.164	0.446	-0.713
ROV11	2.00	2.924	1.233	0.127	-0.968
ROV12	1.33	3.504	1.180	-0.434	-0.662
ROV13	1.73	3.125	1.228	-0.124	-0.905
ROV14	1.73	1.958	1.096	0.931	-0.018
ROV15	1.87	2.791	1.253	0.084	-1.009
ROV16	2.00	2.654	1.294	0.275	-1.012
ROV17	2.00	2.472	1.211	0.435	-0.694
ROV18	1.73	1.814	1.046	1.186	0.573
ROV19	1.47	2.563	1.224	0.275	-0.936
ROV20	1.73	2.039	1.279	1.024	-0.071
HBS1	1.33	3.514	1.153	-0.427	-0.604
HBS2	1.47	3.681	1.072	-0.539	-0.324
HBS3	1.73	3.178	1.200	-0.193	-0.824
HBS4	1.73	3.307	1.242	-0.382	-0.830
HBS5	1.33	1.618	1.084	1.774	2.210
HBS6	1.47	3.254	1.336	-0.294	-1.076
HBS7	1.20	3.293	1.272	-0.375	-0.901
HBS8	1.33	3.305	1.289	-0.270	-0.983
HBS9	1.47	3.229	1.114	-0.300	-0.547
HBS10	2.00	3.362	1.192	-0.416	-0.664
HBS11	1.73	3.379	1.083	-0.427	-0.324
HBS12	1.20	3.242	1.225	-0.229	-0.856
HBS13	2.00	2.669	1.215	0.136	-0.999
HBS14	1.33	3.177	1.234	-0.291	-0.875

GAPI1	2.53	2.041	1.030	0.766	-0.178
GAPI2	2.40	1.687	0.913	1.280	1.054
GAPI3	2.53	4.298	0.894	-1.378	1.849
GAPI4	2.27	3.551	1.132	-0.437	-0.613
GAPI5	2.53	2.938	1.113	0.127	-0.706
GAPI6	2.00	3.007	1.074	0.000	-0.579
GAPI7	2.53	3.109	0.980	-0.228	-0.431
GAPI8	2.93	2.938	1.063	-0.069	-0.593
GAPI9	2.80	1.896	0.989	1.034	0.505
GAPI10	2.53	2.724	1.126	0.126	-0.797
GAPI11	2.27	3.483	1.069	-0.167	-0.824
GAPI12	2.80	3.337	1.080	-0.104	-0.712
GAPI13	2.53	3.570	1.041	-0.282	-0.630
GAPI14	2.67	3.866	0.966	-0.495	-0.328
GAPI15	2.53	3.501	1.058	-0.352	-0.497
GAPI16	2.40	3.530	1.055	-0.434	-0.414
GAPI17	2.00	2.233	1.082	0.703	-0.164
GAPI18	2.27	2.188	1.066	0.654	-0.285
GAPI19	2.00	2.437	1.131	0.431	-0.659
GAPI20	2.40	2.127	1.030	0.698	-0.147
GAPI21	2.00	3.808	0.906	-0.603	0.178
GAPI22	2.13	3.693	0.866	-0.524	0.319
GAPI23	1.87	3.796	0.894	-0.469	-0.089
GAPI24	1.87	3.961	0.962	-0.847	0.488
GAPI25	2.27	4.244	0.862	-1.156	1.386
GAPI26	1.73	3.791	1.033	-0.616	-0.171
GAPI27	2.00	3.804	1.058	-0.603	-0.387
GAPI28	2.27	4.362	0.844	-1.414	2.053
GAPI29	2.00	3.948	1.000	-0.835	0.264

GAPI30	1.87	3.677	1.044	-0.559	-0.266
GAPI31	3.20	3.944	0.959	-0.834	0.454
GAPI32	2.40	3.186	1.131	-0.170	-0.685
GAPI33	2.53	3.153	1.146	-0.148	-0.818
GAPI34	2.13	3.289	1.139	-0.260	-0.762
GAPI35	2.53	2.635	1.152	0.164	-0.913
GAPI36	2.13	2.777	1.150	0.050	-0.873
GAPI37	2.67	2.664	1.134	0.147	-0.863
GAPI38	3.47	2.666	1.184	0.162	-0.962
MUL1	1.47	1.892	0.961	0.913	0.278
MUL2	1.20	1.931	1.005	0.832	-0.094
MUL3	1.20	1.686	0.947	1.433	1.653
MUL4	1.47	1.829	1.024	1.168	0.720
MUL5	1.07	3.233	1.302	-0.195	-1.000
MUL6	1.33	2.607	1.263	0.373	-0.836
MUL7	1.20	2.920	1.318	0.104	-1.053
MUL8	1.33	4.180	0.934	-0.781	-0.359
MUL9	1.60	3.702	1.197	-0.412	-0.957
MUL10	1.07	3.856	1.098	-0.525	-0.670
MUL11	1.73	3.020	1.359	0.083	-1.185
MUL12	1.07	3.067	1.257	-0.001	-0.996
MUL13	1.33	3.350	1.183	-0.250	-0.712
MUL14	1.07	3.319	1.218	-0.215	-0.862
MUL15	1.60	3.566	1.170	-0.424	-0.621
GSAB1	2.13	3.954	0.823	-0.589	0.199
GSAB2	1.87	3.675	0.869	-0.515	0.270
GSAB3	1.87	3.202	0.976	-0.159	-0.355
GSAB4	1.87	3.204	1.006	-0.271	-0.298
GSAB5	1.47	3.348	1.055	-0.347	-0.377

GSAB6	1.73	3.939	0.918	-0.700	0.243
GSAB7	1.87	3.243	1.014	-0.217	-0.433
GSAB8	2.13	2.478	1.160	0.304	-0.813
GSAB9	1.73	3.796	0.840	-0.509	0.349
GSAB10	1.47	2.185	1.089	0.615	-0.419
GSAB11	1.60	3.134	1.006	-0.230	-0.427
GSAB12	1.87	4.118	0.832	-0.790	0.385
GSAB13	2.40	2.857	1.201	-0.036	-0.910
GSAB14	2.27	3.078	1.010	-0.148	-0.435
GSAB15	1.60	3.153	1.025	-0.233	-0.446
GSAB16	2.13	3.996	0.917	-0.722	0.246
GSAB17	1.47	2.716	1.265	0.207	-0.984
GSAB18	1.87	4.010	0.834	-0.791	0.824
GSAB19	2.13	3.663	0.965	-0.499	-0.028
GSAB20	2.00	2.784	1.178	0.015	-0.864
GSAB21	1.87	2.905	1.090	0.012	-0.660
GSAB22	1.33	2.914	1.158	0.054	-0.852
GSAB23	1.73	3.497	0.999	-0.436	-0.170
GSAB24	1.73	3.431	0.930	-0.427	0.008
GSAB25	2.00	3.887	0.916	-0.679	0.238
GSAB26	1.87	2.890	1.108	0.080	-0.692
GSAB27	1.73	3.338	1.061	-0.227	-0.518
GSAB28	1.60	2.767	1.145	0.095	-0.761
GSAB29	1.33	2.714	0.981	0.227	-0.310
GSAB30	1.73	2.102	1.102	0.742	-0.328
GSAB31	1.60	4.061	0.783	-0.665	0.513
GSAB32	2.00	2.756	1.143	0.031	-0.825
GSAB33	1.87	3.003	1.108	-0.059	-0.758
GSAB34	1.60	1.925	1.077	0.981	0.156

GSAB35	2.00	3.318	0.958	-0.382	-0.178
GSAB36	1.73	2.841	1.183	0.112	-0.885

Table 6.

CFA Descriptive statistics.

	% Missing	Mean	SD	Skew	Kurtosis
SNIE1	1.35	3.227	0.781	-0.886	0.511
SNIE2	1.35	3.215	0.751	-0.820	0.567
SNIE3	1.89	3.270	0.733	-0.930	0.940
SNIE4	1.49	3.331	0.720	-0.962	0.858
SNIE5	1.62	2.570	0.720	0.053	-0.295
SNIE6	1.89	2.667	0.850	-0.453	-0.351
SNIE7	1.22	2.358	0.887	0.096	-0.736
SNIE8	1.49	2.520	0.906	-0.103	-0.778
SNIE9	1.49	2.535	0.891	-0.152	-0.717
SNIE10	1.62	2.578	0.885	-0.178	-0.679
SNIE11	1.49	2.261	0.876	0.205	-0.677
SNIE12	1.89	2.066	0.744	0.296	-0.236
SNIE13	2.16	2.076	0.757	0.293	-0.298
SNIE14	1.76	2.111	0.733	0.264	-0.182
SNIE15	1.35	2.316	0.782	-0.067	-0.582
SNIE16	1.35	2.203	0.786	0.187	-0.435
DISHB1	1.89	3.613	0.899	-0.368	0.040
DISHB2	3.11	4.110	0.848	-0.802	0.470
DISHB3	1.89	3.897	0.892	-0.588	0.126
DISHB4	2.03	3.745	0.936	-0.495	-0.006
DISHB5	1.76	3.510	0.962	-0.303	-0.316
DISHB6	1.89	3.336	1.018	-0.104	-0.652
DISHB7	2.43	3.542	1.029	-0.478	-0.197
DISHB8	1.76	2.791	1.076	0.170	-0.538
DISHA1	1.08	4.113	0.840	-0.838	0.753
DISHA2	1.22	3.770	0.970	-0.562	-0.088
DISHA3	1.49	3.550	0.982	-0.344	-0.305
DISHA4	1.08	3.314	1.038	-0.119	-0.655

DISHA5	1.62	3.620	1.009	-0.416	-0.324
DISHA6	0.81	2.856	1.118	0.216	-0.662
PETOSA1	1.35	3.622	1.062	-0.543	-0.211
PETOSA2	1.35	3.452	1.102	-0.493	-0.401
PETOSA3	1.49	2.123	1.282	0.866	-0.407
PETOSA4	1.89	2.015	1.230	0.984	-0.150
PETOSA5	1.22	1.917	1.131	1.043	0.093
PETOSA6	1.22	3.601	1.098	-0.610	-0.159
PETOSA7	1.49	3.457	1.064	-0.508	-0.155
PETOSA8	1.62	3.488	1.001	-0.538	0.073
PETOSA9	1.22	3.893	1.064	-0.845	0.192
PETOSA10	1.49	1.754	1.085	1.316	0.709
PETOSA11	1.35	2.648	1.236	0.125	-1.020
PETOSA12	1.22	3.729	0.995	-0.682	0.213
PETOSA13	1.35	2.016	1.238	0.969	-0.226
PETOSA14	1.49	3.016	1.222	-0.072	-0.898
PETOSA15	1.49	1.704	1.050	1.409	1.093
PETOSA16	1.35	2.352	1.147	0.397	-0.806
PETOSA17	1.76	2.662	1.142	0.021	-0.842
PETOSA18	1.35	1.814	1.053	1.213	0.692
PETOSA19	1.22	2.127	1.116	0.552	-0.773
PETOSA20	1.76	1.682	0.966	1.337	0.997
PETOSA21	1.62	2.562	1.067	0.104	-0.604
PETOSA22	2.57	2.105	1.147	0.730	-0.429
PETOSA23	1.62	1.974	1.122	0.857	-0.282
PETOSA24	1.22	1.850	1.114	1.083	0.062
PETOSA25	1.35	2.068	1.199	0.717	-0.729
PETOSA26	1.49	4.096	1.172	-1.128	0.283
PETOSA27	1.35	2.782	1.266	0.130	-0.981

PETOSA28	1.08	1.818	1.106	1.222	0.556
PETOSA29	2.03	2.323	1.155	0.440	-0.762
PETOSA30	1.89	3.751	1.190	-0.729	-0.269
PETOSA31	1.22	2.289	1.182	0.477	-0.850
PETOSA32	1.35	2.604	1.083	0.230	-0.556
PETOSA33	1.76	2.707	1.085	0.115	-0.575
PETOSA34	1.35	2.848	1.127	-0.010	-0.695
PETOSA35	1.35	2.305	1.125	0.495	-0.572
PETOSA36	1.08	3.331	1.040	-0.384	-0.356
PETOSA37	1.22	3.754	0.997	-0.669	0.177
PETOSA38	2.16	3.767	0.912	-0.529	0.185
PETOSA39	1.08	3.943	0.981	-0.745	0.111
PETOSA40	1.49	3.595	1.132	-0.460	-0.537
PETOSA41	1.08	3.422	1.091	-0.413	-0.408
PETOSA42	0.95	2.135	1.244	0.754	-0.578
PETOSA43	1.62	2.628	1.180	0.238	-0.739
PETOSA44	1.35	2.386	1.034	0.361	-0.396
PETOSA45	2.03	2.702	1.051	0.009	-0.549
PETOSA46	1.08	2.762	1.049	0.002	-0.530
PETOSA47	1.89	1.755	1.021	1.317	1.036
PETOSA48	1.35	1.727	1.007	1.418	1.452
PETOSA49	1.62	1.805	1.000	1.123	0.523
PETOSA50	1.35	2.442	1.150	0.319	-0.827
PETOSA51	0.95	2.535	1.199	0.291	-0.868
ROV1	2.03	3.379	1.140	-0.303	-0.555
ROV2	1.62	3.056	1.207	-0.113	-0.859
ROV3	1.62	2.615	1.221	0.257	-0.862
ROV4	1.89	3.320	1.143	-0.397	-0.484
ROV5	1.76	2.802	1.136	0.021	-0.778

ROV6	1.76	2.809	1.183	0.069	-0.865
ROV7	1.76	2.593	1.136	0.190	-0.831
ROV8	2.43	3.132	1.094	-0.274	-0.587
ROV9	2.30	2.726	1.168	0.106	-0.868
ROV10	1.62	2.367	1.132	0.437	-0.651
ROV11	1.76	2.898	1.265	0.057	-1.002
ROV12	1.76	3.484	1.230	-0.439	-0.727
ROV13	1.49	3.125	1.214	-0.092	-0.911
ROV14	2.43	1.971	1.072	1.002	0.285
ROV15	1.89	2.809	1.251	0.145	-0.961
ROV16	2.30	2.586	1.263	0.358	-0.905
ROV17	2.03	2.512	1.242	0.409	-0.805
ROV18	1.89	1.876	1.107	1.128	0.398
ROV19	1.35	2.701	1.266	0.253	-0.930
ROV20	1.62	1.979	1.210	1.044	0.059
HBS1	1.35	3.526	1.121	-0.377	-0.576
HBS2	2.16	3.637	1.080	-0.486	-0.395
HBS3	1.89	3.179	1.150	-0.168	-0.765
HBS4	1.49	3.298	1.198	-0.376	-0.732
HBS5	1.62	1.622	1.056	1.650	1.712
HBS6	2.03	3.154	1.337	-0.238	-1.099
HBS7	2.03	3.126	1.315	-0.203	-1.059
HBS8	1.62	3.290	1.349	-0.230	-1.144
HBS9	2.03	3.182	1.105	-0.216	-0.526
HBS10	2.03	3.266	1.173	-0.337	-0.718
HBS11	1.49	3.299	1.075	-0.382	-0.435
HBS12	1.89	3.220	1.183	-0.197	-0.771
HBS13	1.76	2.641	1.185	0.199	-0.883
HBS14	1.49	3.147	1.249	-0.223	-0.961

GAPI1	2.16	1.965	1.044	0.928	0.115
GAPI2	1.76	1.622	0.866	1.343	1.243
GAPI3	1.89	4.248	0.909	-1.244	1.484
GAPI4	2.16	3.435	1.119	-0.387	-0.571
GAPI5	1.62	2.959	1.136	-0.009	-0.743
GAPI6	1.89	2.939	1.087	0.024	-0.607
GAPI7	1.76	3.140	0.982	-0.187	-0.436
GAPI8	2.30	2.917	1.019	-0.140	-0.548
GAPI9	2.70	1.828	0.929	0.960	0.264
GAPI10	1.89	2.702	1.124	0.154	-0.822
GAPI11	2.30	3.510	1.069	-0.299	-0.536
GAPI12	2.16	3.327	1.083	-0.140	-0.759
GAPI13	2.03	3.578	1.017	-0.377	-0.292
GAPI14	1.76	3.801	0.979	-0.561	-0.093
GAPI15	2.84	3.455	1.070	-0.386	-0.392
GAPI16	2.03	3.508	1.043	-0.425	-0.342
GAPI17	2.03	2.201	1.010	0.723	0.034
GAPI18	2.30	2.232	1.073	0.652	-0.282
GAPI19	1.89	2.383	1.095	0.441	-0.604
GAPI20	2.03	2.138	1.039	0.710	-0.145
GAPI21	2.84	3.784	0.930	-0.628	0.245
GAPI22	2.16	3.695	0.897	-0.421	-0.009
GAPI23	1.89	3.788	0.892	-0.445	-0.052
GAPI24	1.89	3.978	0.935	-0.836	0.571
GAPI25	1.89	4.248	0.838	-1.080	1.195
GAPI26	2.03	3.855	1.000	-0.718	0.112
GAPI27	1.76	3.823	1.054	-0.644	-0.310
GAPI28	1.62	4.359	0.827	-1.431	2.382
GAPI29	1.49	3.989	0.940	-0.750	0.088

GAPI30	1.76	3.684	1.012	-0.477	-0.352
GAPI31	1.89	3.959	0.928	-0.724	0.220
GAPI32	1.89	3.227	1.164	-0.165	-0.830
GAPI33	1.89	3.145	1.176	-0.098	-0.899
GAPI34	2.30	3.288	1.159	-0.233	-0.799
GAPI35	1.49	2.599	1.160	0.239	-0.849
GAPI36	2.03	2.699	1.157	0.083	-0.881
GAPI37	2.70	2.540	1.158	0.275	-0.820
GAPI38	3.38	2.617	1.160	0.200	-0.866
MUL1	1.62	1.924	1.020	1.036	0.634
MUL2	2.03	1.956	1.037	0.986	0.383
MUL3	2.03	1.714	0.996	1.406	1.439
MUL4	1.62	1.872	1.106	1.143	0.434
MUL5	1.76	3.155	1.287	-0.105	-0.977
MUL6	2.03	2.610	1.295	0.358	-0.964
MUL7	1.76	2.851	1.375	0.144	-1.151
MUL8	2.16	4.182	0.998	-1.029	0.362
MUL9	1.76	3.733	1.194	-0.505	-0.829
MUL10	2.03	3.901	1.045	-0.599	-0.405
MUL11	2.03	3.025	1.325	0.104	-1.148
MUL12	1.62	3.091	1.229	-0.017	-0.932
MUL13	1.62	3.348	1.146	-0.229	-0.655
MUL14	1.89	3.329	1.166	-0.265	-0.685
MUL15	1.76	3.550	1.134	-0.393	-0.488
GSAB1	1.89	3.934	0.849	-0.792	0.933
GSAB2	2.57	3.649	0.876	-0.435	0.155
GSAB3	2.30	3.188	0.956	-0.258	-0.155
GSAB4	2.16	3.229	0.994	-0.394	-0.196
GSAB5	2.03	3.379	1.028	-0.425	-0.309

GSAB6	2.03	3.985	0.864	-0.714	0.322
GSAB7	2.70	3.231	0.999	-0.230	-0.387
GSAB8	2.03	2.514	1.189	0.259	-0.907
GSAB9	2.43	3.834	0.853	-0.575	0.380
GSAB10	2.03	2.171	1.088	0.648	-0.386
GSAB11	2.30	3.196	1.019	-0.313	-0.358
GSAB12	2.84	4.161	0.796	-0.841	0.716
GSAB13	2.03	2.810	1.223	-0.063	-1.055
GSAB14	2.16	3.112	0.992	-0.301	-0.379
GSAB15	2.16	3.184	1.022	-0.256	-0.321
GSAB16	2.43	4.051	0.861	-0.774	0.466
GSAB17	2.16	2.648	1.253	0.315	-0.899
GSAB18	2.30	4.007	0.796	-0.754	0.908
GSAB19	2.43	3.686	0.910	-0.629	0.424
GSAB20	2.70	2.772	1.167	-0.071	-0.923
GSAB21	2.84	2.894	1.058	-0.043	-0.621
GSAB22	2.16	2.891	1.205	0.016	-0.890
GSAB23	1.89	3.478	0.923	-0.356	-0.134
GSAB24	2.57	3.479	0.894	-0.343	-0.101
GSAB25	2.70	3.935	0.865	-0.608	0.137
GSAB26	2.30	2.899	1.130	0.055	-0.692
GSAB27	2.43	3.323	1.003	-0.315	-0.445
GSAB28	2.70	2.692	1.154	0.142	-0.834
GSAB29	2.16	2.657	1.007	0.155	-0.450
GSAB30	2.43	2.053	1.064	0.682	-0.384
GSAB31	2.57	4.029	0.791	-0.724	0.677
GSAB32	2.03	2.812	1.184	-0.043	-0.838
GSAB33	2.16	2.959	1.154	0.000	-0.799
GSAB34	1.89	1.886	1.030	0.993	0.171

GSAB35	2.57	3.362	0.912	-0.357	-0.166
GSAB36	1.76	2.871	1.147	0.057	-0.807

Table 7.

Fit indices, number of factors, and number of items for each factor analysis.

Step	Analyses Type	Chi-square	DF	TLI	CFI	AIC	RMSEA	# Factors	# of Items in Model	# of Items loading <.4
1	EFA	28680.1	14853	0.842	0.88	333062.9	0.035	25	203	58
2	EFA	27647.81	8766	0.742	0.783	249010	0.054	12	145	18
3a	EFA	34223.44	7376	0.613	0.644	228093	0.07	5	127	--
3a	EFA	31451.19	7254	0.646	0.679	225564.8	0.067	6	127	--
3a	EFA	28988.29	7133	0.675	0.71	223343.9	0.064	7	127	--
3a	EFA	27119.96	7013	0.696	0.733	221715.5	0.062	8	127	22
3a	EFA	25081.66	6894	0.720	0.759	219915.2	0.059	9	127	--
3a	EFA	23570.45	6776	0.737	0.777	218640	0.057	10	127	--
3a	EFA	22250.47	6659	0.751	0.793	217554	0.056	11	127	--
3a	EFA	20837.32	6543	0.768	0.81	216372.9	0.054	12	127	--
3b	CFA	33099.38	7439	0.604	0.62	224870.8	0.068	8	127	12
4a	EFA	29046.31	5990	0.622	0.654	207481.3	0.072	5	115	--
4a	EFA	26610.92	5880	0.654	0.689	205265.9	0.069	6	115	--
4a	EFA	24763.88	5771	0.677	0.715	203636.8	0.066	7	115	--
4a	EFA	22791.73	5663	0.703	0.743	201880.7	0.064	8	115	14
4a	EFA	20641.15	5556	0.733	0.774	199944.1	0.06	9	115	--
4b	CFA	28572.65	6312	0.629	0.643	205561.4	0.069	8	115	5
5a	EFA	27443.48	5455	0.621	0.655	197797.3	0.073	5	110	--
5a	EFA	25020.88	5350	0.654	0.692	195584.7	0.07	6	110	--

5a	EFA	23230.9	5246	0.678	0.718	194002.8	0.068	7	110	--
5a	EFA	21329.53	5143	0.704	0.746	192307.4	0.065	8	110	8
5a	EFA	19167.32	5041	0.737	0.779	190349.2	0.061	9	110	--
5b	CFA	26722.88	5800	0.639	0.651	196195.2	0.07	8	110	5
5c	EFA	25601.76	4945	0.628	0.663	187971.4	0.075	5	105	--
5c	EFA	23163.22	4845	0.663	0.701	185732.9	0.071	6	105	--
5c	EFA	21379	4746	0.688	0.729	184146.7	0.068	7	105	--
5c	EFA	19497.49	4648	0.716	0.758	182461.2	0.065	8	105	9
5c	EFA	17392.37	4551	0.749	0.791	180550	0.061	9	105	--
5d	CFA	22018.02	4436	0.666	0.675	168666.8	0.073	8	105	8
6	CFA	12286.54	4388	0.848	0.854	159031.4	0.049	8	96	--
7	CFA	12650.86	4408	0.843	0.848	159355.7	0.050	8	96	--
8	CFA	10215.54	4203	0.863	0.868	158694.3	0.044	7	96	--

Table 8.

Correlated residuals for Step 6 CFA.

Variable	Correlated Variables	Correlation
GSAB36		
	GSAB22	0.685
PETOSA4		
	PETOSA3	0.565
PETOSA48		
	PETOSA47	0.796
MUL14		
	MUL13	0.843
SNIE3		
	SNIE1	0.748
	SNIE2	0.676
MUL15		
	MUL14	0.745
	MUL13	0.728
GAPI16		
	GAPI15	0.708
GAPI37		
	GAPI36	0.433
SNIE14		
	SNIE13	0.502
SNIE2		
	SNIE1	0.675
SNIE9		
	SNIE8	0.407
	SNIE10	0.284
SNIE4		
	SNIE3	0.636

	SNIE1	0.599
	SNIE2	0.543
ROV18		
	ROV14	0.607
ROV16		
	ROV15	0.516
MUL7		
	MUL6	0.578
SNIE13		
	SNIE12	0.375
HBS7		
	HBS6	0.499
GAPI23		
	GAPI21	0.544
	GAPI22	0.513
HBS2		
	HBS1	0.515
GAPI31		
	GAPI30	0.52
	GAPI29	0.468
GAPI34		
	GAPI33	0.26
SNIE8		
	SNIE7	0.359
HBS9		
	HBS10	0.465
ROV7		
	ROV6	0.442
SNIE16		

	SNIE15	0.402
GAPI14		
	GAPI13	0.328
GAPI30		
	GAPI29	0.471
GAPI13		
	GAPI11	0.408
	GAPI12	0.402
GSAB7		
	GSAB26	0.322
PETOSA9		
	PETOSA39	0.385
ROV19		
	ROV15	0.263
GAPI22		
	GAPI21	0.439
PETOSA40		
	PETOSA39	0.285
ROV17		
	ROV13	0.42
GSAB5		
	GSAB19	0.439
GAPI12		
	GAPI11	0.437
GSAB29		
	GSAB26	0.314
HBS6		
	HBS4	0.275
PETOSA39		

	PETOSA38	0.409
ROV2		
	ROV1	0.359

Note. All p values < .001

Table 9.

Completely standardized factor loadings, standard errors, and p values for final CFA model.

Factor	Indicators	Loading	S.E.
Self-Regulation Self-Efficacy			
	GAPI11	0.673	0.023
	GAPI12	0.720	0.020
	GAPI13	0.779	0.016
	GAPI14	0.802	0.016
	GAPI15	0.658	0.023
	GAPI16	0.634	0.024
	GAPI21	0.463	0.031
	GAPI22	0.566	0.027
	GAPI23	0.518	0.029
	GAPI24	0.423	0.032
	GAPI29	0.664	0.023
	GAPI30	0.656	0.023
	GAPI31	0.685	0.022
	GSAB19	0.633	0.025
	GSAB2	0.573	0.027
	GSAB24	0.615	0.025
	GSAB26	0.590	0.027
	GSAB7	0.587	0.027
Negative Affect			
	GAPI32	0.844	0.015
	GAPI33	0.829	0.017
	GAPI34	0.866	0.015

	GAPI4	0.617	0.026
	GSAB29	0.385	0.033
	MUL6	0.526	0.030
	MUL7	0.561	0.028
Goal Setting/ Goal Planning			
	HBS1	0.765	0.016
	HBS10	0.688	0.020
	HBS14	0.688	0.020
	HBS2	0.751	0.017
	HBS3	0.750	0.017
	HBS4	0.765	0.016
	HBS6	0.731	0.018
	HBS7	0.655	0.022
	HBS8	0.681	0.021
	HBS9	0.654	0.022
	MUL10	0.643	0.023
	MUL13	0.582	0.025
	MUL14	0.593	0.025
	MUL15	0.609	0.024
	PETOSA41	0.688	0.020
	PETOSA43	0.640	0.023
	ROV1	0.789	0.015
	ROV12	0.561	0.026
	ROV13	0.408	0.032

	ROV14	0.549	0.027
	ROV15	0.714	0.019
	ROV16	0.699	0.020
	ROV17	0.500	0.029
	ROV18	0.455	0.030
	ROV19	0.586	0.025
	ROV2	0.721	0.019
	ROV3	0.620	0.024
	ROV4	0.740	0.018
	ROV6	0.666	0.021
	ROV7	0.686	0.020
	SNIE1	0.672	0.021
	SNIE2	0.659	0.022
	SNIE3	0.668	0.021
	SNIE4	0.635	0.023
Goal Communications			
	GAPI35	0.724	0.021
	GAPI36	0.818	0.018
	GAPI37	0.842	0.016
	GAPI38	0.820	0.017
	HBS12	0.351	0.035
	ROV10	0.602	0.027
[Removed Factor]			
	GSAB15	0.670	0.026

	GSAB22	0.331	0.039
	GSAB36	0.351	0.039
	GSAB5	0.606	0.029
	PETOSA33	0.431	0.034
Goal Setting/ Outcome Expectancy			
	DISHB2	0.611	0.026
	PETOSA12	0.769	0.017
	PETOSA37	0.619	0.025
	PETOSA38	0.629	0.025
	PETOSA39	0.641	0.023
	PETOSA40	0.477	0.031
	PETOSA6	0.753	0.018
	PETOSA7	0.755	0.018
	PETOSA8	0.750	0.018
	PETOSA9	0.674	0.022
Self Monitoring			
	PETOSA13	0.803	0.015
	PETOSA3	0.834	0.014
	PETOSA4	0.886	0.010
	PETOSA47	0.683	0.021
	PETOSA48	0.697	0.021
	PETOSA5	0.917	0.009
Goal Planning			
	SNIE10	0.798	0.016

SNIE11	0.643	0.023
SNIE12	0.798	0.016
SNIE13	0.796	0.015
SNIE14	0.815	0.015
SNIE15	0.809	0.015
SNIE16	0.796	0.016
SNIE7	0.790	0.017
SNIE8	0.772	0.017
SNIE9	0.807	0.015

Note. All loadings significant at $p < .001$

Table 10.

Step 6 CFA factor correlations and reliabilities.

Factors	1	2	3	4	5	6	7	8	
1. Self-Regulation Self-Efficacy	--								0.927
2. Negative Affect	0.469	--							0.850
3. Goal Setting/ Goal Planning	0.762	0.432	--						0.959
4. Goal Communications	0.345	0.333	0.358	--					0.854
5. [Removed factor]	--	--	--	--	--				0.588
6. Goal Setting/ Outcome Expectancy	0.723	0.454	0.782	0.249	--	--			0.890
7. Self Monitoring	0.273	0.211	0.463	0.336	--	0.236	--		0.922
8. Goal Planning	0.470	0.257	0.656	0.377	--	0.387	0.546	--	0.940

Note: All p values < .001.

Table 11.

Structural Equation Model of self-regulation constructs predicting PA (completely standardized results).

Predictor	β	SE	*p* value
Self-Regulation Self-Efficacy	0.087	0.080	0.280
Negative Affect	0.016	0.045	0.716
Goal Setting/ Goal Planning	0.861	0.106	$p < .001$
Goal Communications	-0.044	0.042	0.298
Goal Setting/ Outcome Expectancy	-0.261	0.085	0.002
Self Monitoring	0.046	0.045	0.314
Goal Planning	-0.093	0.061	0.126

Table 12.

Original measure scale scores predicting PA.

Predictor	β	SE	*p* value
Dishman et al., (2005)	-0.043	0.062	0.489
Dishman et al., (2002)	0.226	0.070	0.001
Petosa, 1993	0.013	0.063	0.840
Rovniak et al, (2002)	0.113	0.078	0.147
HBS	0.253	0.074	0.001
GAPI	0.007	0.061	0.903
GSAB	-0.051	0.055	0.352
Sniehotta et al., (2005)	0.070	0.062	0.263
Mullan et al., (1997)	0.262	0.055	<0.001

Table 13.

Final communality estimates for the eight factor Step 5c EFA.

Variable	Final Communality
DISHB1	0.405
DISHB2	0.54
GAPI1	0.228
GAPI11	0.53
GAPI12	0.599
GAPI13	0.643
GAPI14	0.677
GAPI15	0.467
GAPI16	0.457
GAPI21	0.315
GAPI22	0.426
GAPI23	0.37
GAPI24	0.379
GAPI29	0.556
GAPI30	0.57
GAPI31	0.552
GAPI32	0.593
GAPI33	0.622
GAPI34	0.603
GAPI35	0.55
GAPI36	0.755
GAPI37	0.771

GAPI38	0.648
GAPI4	0.456
GSAB15	0.802
GSAB19	0.34
GSAB2	0.331
GSAB22	0.738
GSAB24	0.488
GSAB26	0.464
GSAB29	0.359
GSAB36	0.492
GSAB5	0.728
GSAB7	0.513
GSAB9	0.285
HBS1	0.576
HBS10	0.532
HBS12	0.323
HBS14	0.447
HBS2	0.625
HBS3	0.572
HBS4	0.56
HBS6	0.483
HBS7	0.443
HBS8	0.547
HBS9	0.491
MUL10	0.618

MUL13	0.5
MUL14	0.503
MUL15	0.513
MUL2	0.252
MUL3	0.266
MUL4	0.211
MUL6	0.481
MUL7	0.519
PETOSA11	0.395
PETOSA12	0.64
PETOSA13	0.659
PETOSA14	0.336
PETOSA3	0.851
PETOSA33	0.474
PETOSA37	0.497
PETOSA38	0.556
PETOSA39	0.61
PETOSA4	0.887
PETOSA40	0.49
PETOSA41	0.577
PETOSA43	0.525
PETOSA47	0.529
PETOSA48	0.567
PETOSA5	0.819
PETOSA6	0.501

PETOSA7	0.519
PETOSA8	0.554
PETOSA9	0.56
ROV1	0.634
ROV10	0.421
ROV12	0.397
ROV13	0.294
ROV14	0.544
ROV15	0.531
ROV16	0.577
ROV17	0.329
ROV18	0.505
ROV19	0.392
ROV2	0.517
ROV3	0.392
ROV4	0.547
ROV5	0.326
ROV6	0.548
ROV7	0.535
SNIE1	0.653
SNIE10	0.644
SNIE11	0.45
SNIE12	0.7
SNIE13	0.765
SNIE14	0.777

SNIE15	0.673
SNIE16	0.715
SNIE2	0.643
SNIE3	0.625
SNIE4	0.556
SNIE7	0.607
SNIE8	0.549
SNIE9	0.586

Table 14.

Eigenvalues for the eight factor Step 5c EFA.

Factor	Eigenvalue
1	31.548
2	8.396
3	5.085
4	3.959
5	3.277
6	2.552
7	2.403
8	2.15
9	2.095
10	1.953
11	1.64
12	1.554
13	1.349
14	1.334
15	1.248
16	1.159
17	1.079
18	1.009
19	0.993
20	0.938
21	0.915

22	0.853
23	0.832
24	0.781
25	0.755
26	0.748
27	0.725
28	0.687
29	0.667
30	0.66
31	0.615
32	0.608
33	0.58
34	0.558
35	0.545
36	0.536
37	0.524
38	0.509
39	0.504
40	0.484
41	0.479
42	0.469
43	0.459
44	0.447
45	0.433

46	0.419
47	0.41
48	0.397
49	0.386
50	0.384
51	0.379
52	0.37
53	0.363
54	0.358
55	0.357
56	0.34
57	0.335
58	0.329
59	0.322
60	0.313
61	0.307
62	0.3
63	0.296
64	0.292
65	0.286
66	0.279
67	0.265
68	0.257
69	0.255
70	0.248

71	0.242
72	0.24
73	0.238
74	0.232
75	0.219
76	0.217
77	0.214
78	0.211
79	0.203
80	0.199
81	0.195
82	0.19
83	0.185
84	0.181
85	0.175
86	0.17
87	0.168
88	0.165
89	0.161
90	0.158
91	0.154
92	0.146
93	0.145
94	0.14
95	0.134

96	0.131
97	0.128
98	0.115
99	0.109
100	0.104
101	0.098
102	0.093
103	0.075
104	0.066
105	0.061

Table 15.

Item loadings from the eight factor Step 5c EFA.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
GAPI11	**0.700**	0.114	0.047	0.027	-0.006	-0.106	0.123	0.006
GAPI12	**0.628**	0.219	0.114	0.076	0.039	-0.108	0.077	0.078
GAPI13	**0.774**	0.134	0.018	0.032	-0.026	-0.040	0.073	0.030
GAPI14	**0.788**	0.134	0.037	0.069	-0.020	-0.037	0.048	-0.015
GAPI15	**0.577**	0.209	-0.004	0.127	0.020	0.021	0.081	-0.030
GAPI16	**0.558**	0.218	-0.017	0.138	0.004	0.034	0.088	-0.007
GAPI21	**0.571**	-0.033	-0.141	0.022	-0.008	0.102	0.059	0.007
GAPI22	**0.638**	-0.038	-0.093	0.005	0.032	0.092	0.016	0.054
GAPI23	**0.637**	-0.062	-0.166	-0.015	-0.011	0.079	0.042	0.058
GAPI24	**0.508**	0.209	-0.200	0.023	0.060	0.218	-0.038	-0.004
GAPI29	**0.699**	-0.009	-0.025	0.007	0.065	0.075	-0.022	0.053
GAPI30	**0.686**	-0.073	0.054	0.014	0.063	-0.008	-0.003	0.116
GAPI31	**0.670**	-0.007	-0.030	0.037	0.028	0.146	-0.038	0.044
GSAB19	**0.484**	-0.067	0.037	-0.017	0.053	0.148	-0.037	-0.038
GSAB2	**0.420**	-0.062	0.085	-0.036	-0.021	0.221	-0.023	-0.077
GSAB24	**0.476**	0.002	0.106	-0.075	0.241	0.077	-0.014	0.130
GSAB26	**0.463**	0.222	0.079	-0.030	0.140	0.139	0.009	-0.018
GSAB7	**0.491**	0.238	0.103	-0.014	0.117	0.148	-0.014	-0.052
GAPI32	0.255	**0.699**	0.021	0.054	-0.013	-0.022	-0.025	0.012
GAPI33	0.152	**0.748**	0.005	0.090	-0.013	-0.038	-0.030	0.023
GAPI34	0.200	**0.709**	0.068	0.113	-0.030	-0.047	-0.009	-0.059
GAPI4	0.152	**0.568**	0.021	-0.044	0.037	0.205	-0.071	-0.002
GSAB29	0.004	**0.521**	-0.046	-0.002	0.153	0.016	0.083	0.071
MUL6	0.004	**0.552**	0.214	-0.130	-0.031	0.239	-0.012	-0.013
MUL7	-0.068	**0.565**	0.238	-0.080	-0.066	0.154	0.066	0.119
HBS1	0.075	-0.048	**0.669**	0.039	0.036	0.109	0.000	-0.036

HBS10	-0.012	0.002	**0.479**	0.048	0.067	0.318	0.046	0.022
HBS14	0.017	-0.034	**0.465**	0.049	0.122	0.202	0.051	0.016
HBS2	0.020	-0.015	**0.694**	-0.004	0.058	0.206	-0.022	-0.070
HBS3	-0.036	-0.021	**0.613**	0.070	0.101	0.117	0.064	0.050
HBS4	-0.103	0.015	**0.678**	-0.001	0.060	0.203	0.025	-0.037
HBS6	-0.068	0.020	**0.613**	0.006	0.042	0.177	0.045	-0.023
HBS7	0.055	0.003	**0.458**	-0.003	0.085	0.238	0.093	-0.056
HBS8	-0.003	0.004	**0.636**	0.036	-0.002	0.151	0.050	0.009
HBS9	-0.017	-0.016	**0.489**	0.025	0.111	0.256	0.052	0.018
MUL10	0.250	0.119	**0.562**	-0.083	-0.017	0.138	-0.038	-0.004
MUL13	0.325	-0.134	**0.463**	-0.054	-0.026	-0.048	0.045	0.130
MUL14	0.347	-0.129	**0.421**	-0.095	0.031	0.012	0.047	0.106
MUL15	0.357	-0.124	**0.422**	-0.071	0.006	0.024	0.041	0.105
PETOSA41	0.006	0.058	**0.475**	0.041	-0.063	0.391	0.003	0.056
PETOSA43	-0.006	0.144	**0.479**	-0.002	-0.053	0.086	0.168	0.179
ROV1	0.075	-0.019	**0.623**	0.063	0.073	0.199	0.012	-0.034
ROV12	0.209	-0.027	**0.543**	-0.073	-0.093	0.012	-0.047	-0.019
ROV13	0.124	-0.123	**0.527**	-0.010	-0.027	-0.122	-0.077	0.037
ROV14	-0.124	0.205	**0.515**	-0.040	0.049	-0.176	0.130	0.264
ROV15	-0.062	0.065	**0.691**	0.068	0.043	-0.035	-0.063	0.101
ROV16	-0.051	0.037	**0.685**	0.058	0.013	-0.046	0.011	0.148
ROV17	0.021	-0.070	**0.578**	-0.021	-0.059	-0.169	-0.023	0.118
ROV18	-0.151	0.181	**0.453**	-0.013	0.091	-0.176	0.137	0.271
ROV19	-0.079	0.028	**0.562**	0.029	0.051	-0.034	-0.026	0.159
ROV2	0.079	0.041	**0.542**	-0.005	0.068	0.107	0.037	0.080
ROV3	-0.084	0.032	**0.421**	0.107	0.137	0.004	0.150	0.076
ROV4	0.076	-0.025	**0.560**	0.034	0.137	0.114	0.042	0.019
ROV6	0.103	-0.054	**0.492**	0.092	0.142	-0.027	0.197	0.045
ROV7	0.065	-0.016	**0.445**	0.028	0.194	-0.034	0.129	0.184

SNIE1	0.168	0.036	**0.641**	0.018	-0.099	0.207	-0.063	-0.043
SNIE10	0.082	0.047	**0.431**	0.029	-0.028	-0.034	0.003	0.473
SNIE2	0.123	0.068	**0.653**	0.017	-0.042	0.193	-0.050	-0.042
SNIE3	0.184	0.051	**0.626**	-0.021	-0.079	0.185	-0.053	-0.045
SNIE4	0.165	0.027	**0.564**	0.024	-0.087	0.209	-0.070	-0.010
SNIE7	0.031	0.033	**0.439**	0.062	0.012	-0.121	0.055	0.426
GAPI35	0.035	0.079	-0.042	**0.728**	-0.027	0.004	0.005	0.010
GAPI36	0.074	0.045	0.050	**0.878**	-0.020	-0.016	-0.041	-0.061
GAPI37	0.058	0.028	0.029	**0.872**	0.040	-0.049	-0.020	-0.052
GAPI38	0.072	-0.011	-0.023	**0.751**	0.035	0.007	0.021	0.065
HBS12	-0.024	-0.182	0.096	**0.417**	0.030	0.269	-0.008	0.041
ROV10	-0.069	-0.021	0.243	**0.489**	0.026	0.020	0.096	0.018
GSAB15	0.035	0.002	0.047	0.021	**0.894**	-0.013	-0.013	-0.070
GSAB22	0.030	0.030	-0.020	0.006	**0.848**	-0.031	-0.005	0.040
GSAB36	0.180	0.029	0.024	0.059	**0.571**	0.100	-0.035	0.001
GSAB5	0.094	0.003	0.017	-0.016	**0.845**	0.012	-0.021	-0.046
PETOSA33	-0.039	-0.026	-0.003	0.015	**0.512**	0.213	0.109	0.127
DISHB2	0.274	0.089	0.109	-0.041	0.035	**0.504**	-0.054	-0.040
PETOSA12	0.071	-0.005	0.369	0.019	-0.012	**0.535**	-0.016	0.006
PETOSA37	0.212	-0.061	0.117	-0.029	0.098	**0.493**	-0.006	0.040
PETOSA38	0.236	0.060	0.033	0.009	-0.008	**0.581**	-0.022	0.059
PETOSA39	0.107	0.141	-0.038	0.020	0.036	**0.707**	-0.051	-0.037
PETOSA40	-0.005	0.328	-0.102	-0.042	0.056	**0.603**	0.008	-0.016
PETOSA6	0.007	-0.001	0.307	-0.020	-0.086	**0.520**	0.099	0.022
PETOSA7	0.011	-0.020	0.255	0.081	-0.019	**0.530**	0.058	0.047
PETOSA8	0.106	0.033	0.184	0.019	-0.013	**0.556**	0.091	0.037
PETOSA9	-0.029	0.171	0.048	0.000	0.027	**0.687**	-0.042	-0.002
PETOSA13	0.042	0.015	0.021	-0.006	-0.019	0.069	**0.773**	0.054
PETOSA3	0.063	0.001	0.087	-0.009	-0.021	-0.014	**0.923**	-0.062

PETOSA4	0.075	-0.011	0.043	0.010	-0.021	0.034	**0.949**	-0.060
PETOSA47	-0.062	0.039	-0.093	0.045	0.107	-0.049	**0.466**	0.340
PETOSA48	-0.035	0.033	-0.083	0.079	0.096	-0.060	**0.491**	0.326
PETOSA5	0.022	-0.007	0.067	0.004	0.007	0.002	**0.863**	0.027
SNIE11	-0.010	-0.109	0.112	0.235	0.018	0.053	-0.056	**0.512**
SNIE12	0.003	0.014	0.101	-0.008	0.016	-0.021	0.012	**0.779**
SNIE13	0.011	-0.001	0.042	-0.019	-0.007	0.046	0.006	**0.852**
SNIE14	0.080	-0.030	0.015	-0.009	-0.005	0.058	-0.033	**0.871**
SNIE15	0.112	-0.031	-0.006	0.008	-0.002	0.140	-0.010	**0.769**
SNIE16	0.071	-0.021	0.052	0.024	0.006	0.091	0.038	**0.757**
SNIE8	0.013	0.056	0.350	0.017	-0.004	-0.018	-0.049	**0.523**
SNIE9	0.085	0.042	0.342	0.040	-0.037	-0.008	0.010	**0.500**
DISHB1	0.217	-0.134	0.200	0.040	0.090	0.327	-0.005	0.052
GAPI1	-0.233	0.263	-0.028	0.194	0.004	0.050	0.037	0.152
GSAB9	-0.067	0.129	0.045	0.073	0.378	-0.006	0.121	0.047
MUL2	-0.245	0.247	-0.234	0.185	0.080	0.115	0.055	0.116
MUL3	-0.235	0.245	-0.256	0.179	0.093	0.153	0.075	0.124
MUL4	-0.235	0.268	-0.019	0.076	0.021	0.055	0.118	0.144
PETOSA11	-0.079	-0.023	0.057	0.392	-0.085	0.301	0.119	0.161
PETOSA14	-0.018	-0.193	0.002	0.385	0.030	0.306	0.090	0.075
ROV5	0.004	-0.058	0.345	0.000	0.216	0.026	0.115	0.101

Table 16.

Step 5c EFA factor correlations and point estimate reliabilities.

Factor	1	2	3	4	5	6	7	8	Reliability
1. Self-Regulation Self-Efficacy	--								0.926
2. Negative Affect	.055	--							0.958
3. Goal Setting/ Goal Planning	.479	.176	--						0.871
4. Goal Communications	.119	.241	.238	--					0.884
5. [Removed factor]	.201	.121	.255	.368	--				0.878
6. Goal Setting/ Outcome Expectancy	.391	.158	.401	.143	.253	--			0.922
7. Self Monitoring	.031	.176	.333	.391	.311	.038	--		0.917
8. Goal Planning	.135	.132	.444	.368	.306	.138	.457	--	0.926

Table 17.

Fit indices for exploratory factor analyses of individual self-regulation measures.

Measure	N	Chi-square	Chi-square df	TLI	CFI	AIC	RMSEA	Number of Factors
Dishman et al., 2002	744	172.345	9	0.861	0.916	10798.170	0.156	1
		32.217	4	0.946	0.986	10668.040	0.097	2
Sniehotta et al., 2005	742	343.275	20	0.848	0.891	14014.250	0.148	1
		63.559	13	0.963	0.983	13748.530	0.072	2
GAPI	737	11281.036	665	0.350	0.385	74186.650	0.147	1
		7818.429	628	0.534	0.583	70798.040	0.125	2
		6238.160	592	0.612	0.673	69289.770	0.114	3
		4847.722	557	0.686	0.751	67969.330	0.102	4
		3992.193	523	0.730	0.799	67181.800	0.095	5
		3205.383	490	0.774	0.843	66460.990	0.087	6
		2651.670	458	0.805	0.873	65971.280	0.081	7
		2163.111	427	0.834	0.899	65544.720	0.074	8
		1410.359	397	0.896	0.941	64851.970	0.059	9
		994.805	368	0.931	0.964	64494.420	0.048	10
GSAB	740	5975.922	559	0.651	0.691	63992.940	0.114	2
		4133.934	525	0.753	0.794	62218.960	0.096	3
		3211.220	492	0.801	0.845	61362.240	0.086	4
		2396.681	460	0.849	0.889	60611.700	0.075	5
		1705.984	429	0.893	0.927	59983.010	0.063	6
		1121.155	399	0.935	0.959	59458.180	0.049	7
		749.069	370	0.963	0.978	59144.090	0.037	8
		613.211	342	0.971	0.985	59064.230	0.033	9
		521.555	315	0.976	0.988	59026.580	0.030	10
HBS	742	993.969	77	0.830	0.856	27574.690	0.127	1
		585.718	64	0.883	0.918	27192.440	0.105	2

Mullan et al., 2007	742	4187.925	90	0.473	0.548	29512.140	0.248	1
		2425.572	76	0.642	0.741	27777.780	0.204	2
		873.620	63	0.851	0.911	26251.830	0.132	3
		271.774	51	0.950	0.976	25673.990	0.076	4
Petosa, 1993	743	15208.425	1224	0.428	0.451	103279.680	0.124	1
		9548.417	1174	0.643	0.671	97719.670	0.098	2
		7587.028	1125	0.713	0.746	95856.280	0.088	3
		6236.167	1077	0.760	0.798	94601.420	0.080	4
Rovniack et al., 2002	375	1399.742	170	0.660	0.696	21136.970	0.139	1
		794.828	151	0.800	0.841	20570.050	0.107	2
		460.939	133	0.884	0.919	20272.170	0.081	3
Sniehotta et al., 2005	746	3645.322	104	0.577	0.633	22514.710	0.214	1
		1199.713	89	0.845	0.885	20099.100	0.129	2
		326.186	75	0.958	0.974	19253.570	0.067	3

Table 18.

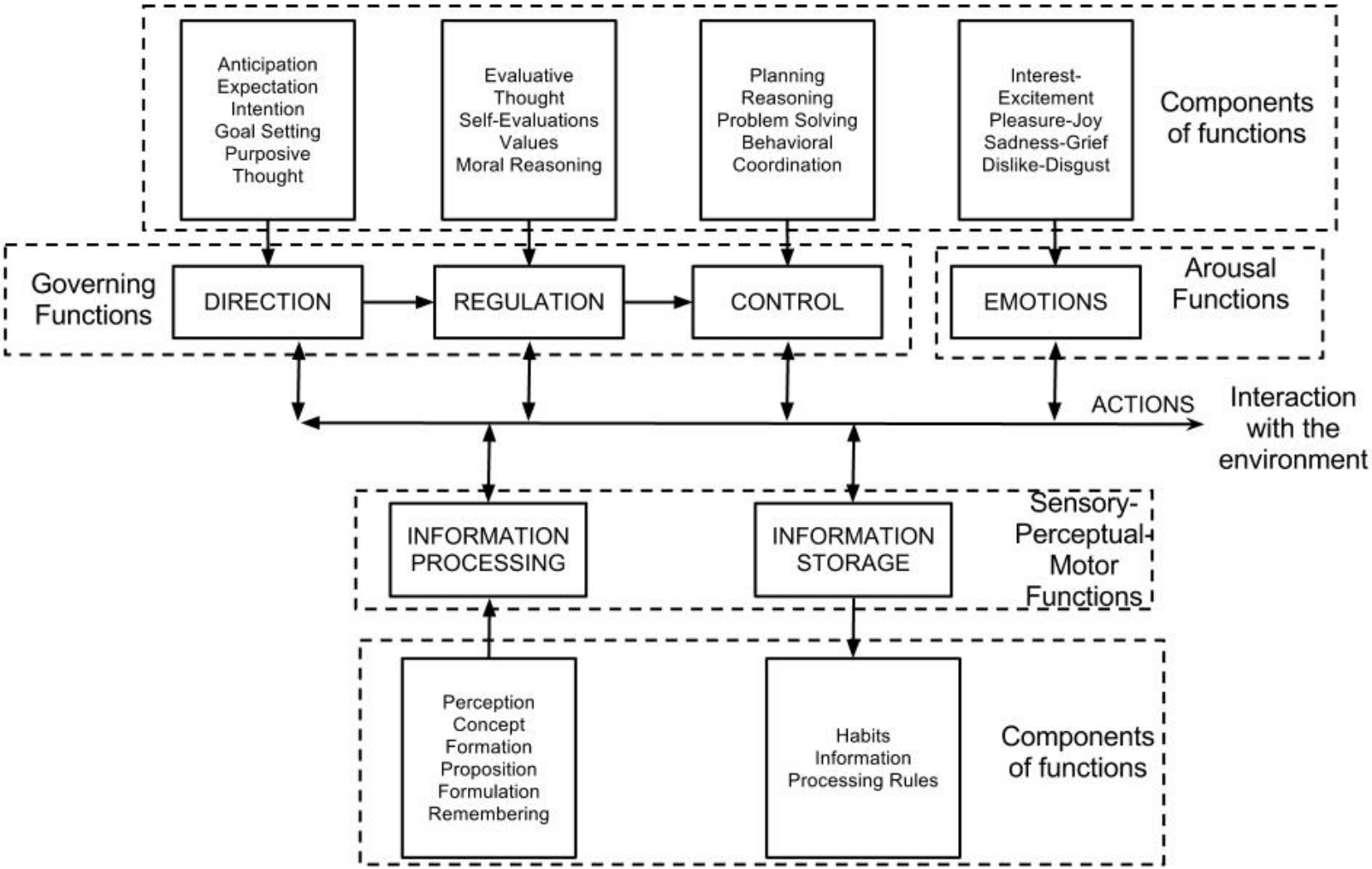
Confirmatory factor analysis model fit indices and reliabilites for idividual measures of self-regulation.

Measure	N	Chi-square	Chi-square df	TLI	CFI	AIC	RMSEA	Factor Name	Reliability
Dishman et al., 2005	735	120.117	9	0.895	0.937	10727.720	0.130	Cognitive Strategies	0.802
								Behavioral Strategies	0.728
Dishman et al., 2002	727	392.876	20	0.798	0.856	13726.630	0.160	Cognitive Strategies	0.801
								Behavioral Strategies	0.713
Sniehotta et al., 2005	732	619.297	101	0.936	0.946	18734.810	0.084	Intentions	0.855
								Action Planning	0.933
								Coping Planning	0.924
Mullan et al. 2007	728	480.801	84	0.944	0.956	25520.720	0.081	External Regulation	0.898
								Introjected Regulation	0.875
								Identified Regulation	0.883
								Intrinsic Regulation	0.953
HBS	730	1096.094	77	0.803	0.833	27228.450	0.135	*	0.925
Rovniack et al., 2002	730	2575.952	170	0.681	0.714	40157.780	0.139		0.929
									0.909
GAPI	729	1988.693	482	0.884	0.900	57921.195	0.065	Feedback/attainability	0.384
								Eternal Control	0.609
								Goal Commitment	0.916
								Goal Alignment	0.908
								Goal Conflict	0.864
								Goal Efficacy	0.837
								Goal Expectancies	0.866
								Goal-related Positive Emotions	0.883
								Goal-related Negative Emotions	0.903

								Goal Communicative Actions	0.890
Petosa, 1993	734	14209.904	1224	0.426	0.449	102568.040	0.120	*	0.949
GSAB	727	2177.370	558	0.888	0.901	59229.636	0.063	Value	0.900
								Self-Efficacy	0.838
								Social Comparison	0.872
								Self-Monitoring	0.710
								Planning/Stimulus Control	0.758
								Self-Criticism	0.904
								Self-Reward	0.878
								Positive Affect	0.898
								Negative Affect	0.833

Note: All *p* values for Chi-squares and reliabilities are $p < .001$. * indicates only one factor

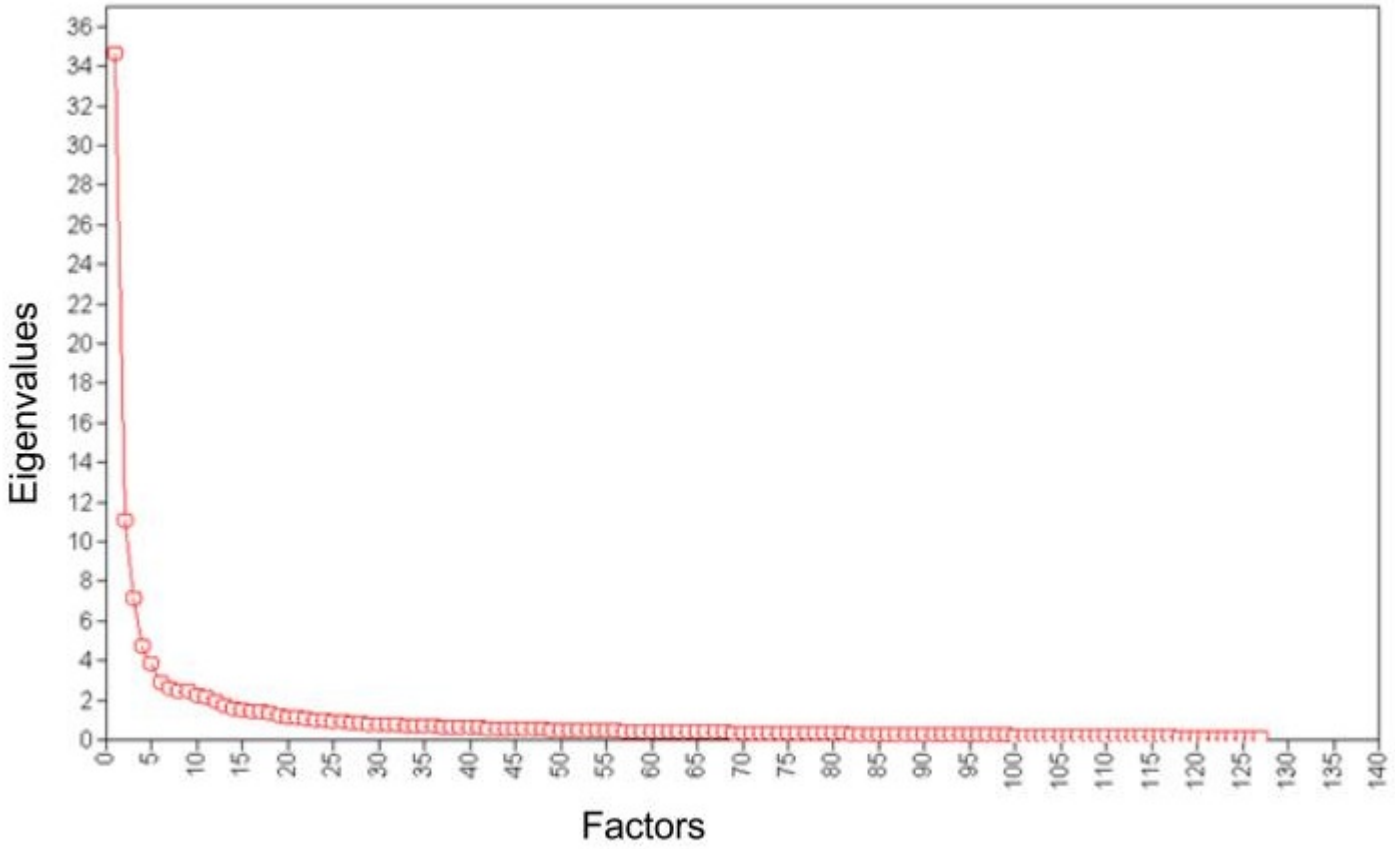
Figure 1. Living systems model from D. Ford's (1987) Transactional adaptive systems



theory.

Note: Arrows represent the feedback and feedword mechanisms used to transfer information in and out of the system

Figure 2. Scree plot of first 50 eigenvalues for 203 variable exploratory factor analysis.



Appendix A—Online Meaure

Before we begin with the survey, please provide the following demographic information.

1. Age:

2. Gender:

Male

Female

3. What is your ethnicity (select all that apply)

American Indian or Alaskan Native

Asian or Pacific Islander

Black, not of Hispanic Origin

Hispanic

White, not of Hispanic Origin

Other

IMPORTANT!! PLEASE READ THESE DIRECTIONS BEFORE CONTINUING.

Thank you for choosing to participate in this study. Before you begin I would like to draw your attention to a few issues that will help you understand what this survey is about and ultimately enhance your experience with this research. With this survey, we are trying to assess different aspects about your physical activity behavior. In fact, this survey consists of several established measures of physical activity behaviors. We are trying to compare these measures in order to assess their reliability and accuracy. As such you may encounter questions that you feel you have previously answered. It is EXTREMELY IMPORTANT that you answer EVERY question, regardless if you think you have answered it before. Moreover, if you feel you have answered the question before, it is not necessary to give the exact answer you previously provided.

Additionally, because the overall survey is comprised of several smaller surveys, you will encounter different directions on each page or even within the page. Please read EACH SET of directions as they will differ from survey to survey.

There is no time limit to complete this survey, so please take your time.

Thank you again for your participation.

HOW OFTEN was each of these things true for you in the LAST MONTH?

1. I think about the benefits I will from being physically active.

Never Rarely Sometimes Often Very often

2. I say positive things to myself about physical activity.

Never Rarely Sometimes Often Very Often

3. When I get off track with my physical activity plans, I tell myself I can start again and get right back on track.

Never Rarely Sometimes Often Very Often

4. I try different kinds of physical activity so that I have more options to choose from.

Never Rarely Sometimes Often Very Often

5. I set goals to do physical activity.

Never Rarely Sometimes Often Very Often

6. I make back-up plans to be sure I get my physical activity.

Never Rarely Sometimes Often Very Often

INSTRUCTIONS

This is a questionnaire about personal goals, plans, or projects you are currently pursuing in relation to your health. In other words, it is about things that you already do or you plan to do in order to improve your health or stay healthy.

We are interested in your personal health-related goals, which can be attained in the coming months. We give you a few examples of such health goals, but keep in mind that your own health goals may naturally not be included in this list.

Examples:

'During the coming months I want to……. FOR EXAMPLE:

go walking for half an hour a day; lose five kilos; have breakfast daily; go to the fitness club three times a week; quit smoking; keep not smoking; get my medication according to the prescription; not drink more than 3 glasses of alcohol per day; floss daily; go to bed on time more often; reduce fat consumption; reduce snacks; walk the dog daily'.

It is important that you formulate goals which are not restricted to a single behavioural act. For example 'Going for a walk this Friday' would be a single behavioural act, and is too restricted for this questionnaire. However, 'Going for a walk every week' is a health goal.

Take a moment now to consider and identify your most important personal health-related goal for the coming months.

The following questions concern your most important personal health-related goal. To what extent do you agree with the following statements:

1. I pursue this goal because other people want me to.

1- Completely disagree 2 3 4 5- Completely agree

2. I pursue this goal to avoid conflict with other people.

1- Completely disagree 2 3 4 5- Completely agree

3. I pursue this goal because it is important to me.

1- Completely disagree 2 3 4 5- Completely agree

4. I pursue this goal because I would feel bad about myself if I didn't.

1- Completely disagree 2 3 4 5- Completely agree

5. It is difficult for me to achieve this goal.

1- Completely disagree 2 3 4 5- Completely agree

6. I wonder whether I am actually making progress towards this goal.

1- Completely disagree 2 3 4 5- Completely agree

7. I think I am doing well on this goal.

1- Completely disagree 2 3 4 5- Completely agree

8. My attainment of this goal depends on external factors.

1- Completely disagree 2 3 4 5- Completely agree

9. My attainment of this goal mainly depends on other people.

1- Completely disagree 2 3 4 5- Completely agree

10. There are things in my environment which stand in the way of attaining my goal.

1- Completely disagree 2 3 4 5- Completely agree

11. Whatever happens, I will not give up this goal.

1- Completely disagree 2 3 4 5- Completely agree

12. I am prepared to do an awful lot in order to reach this goal.

1- Completely disagree 2 3 4 5- Completely agree

13. Even if this goal is difficult to attain, I will not give up on it.

1- Completely disagree 2 3 4 5- Completely agree

14. I am determined to reach this goal.

1- Completely disagree 2 3 4 5- Completely agree

15. This goal contributes to the attainment of other goals I have.

1- Completely disagree 2 3 4 5- Completely agree

16. Working on this goal also contributes to other goals I have.

1- Completely disagree 2 3 4 5- Completely agree

17. This goal makes it difficult to reach other goals I have.

1- Completely disagree 2 3 4 5- Completely agree

18. This goal stands in the way of other things that are important to me.

1- Completely disagree 2 3 4 5- Completely agree

19. In order to achieve this goal I have to give up other things that are important.

1- Completely disagree 2 3 4 5- Completely agree

20. Pursuit of this goal is at the expense of other goals.

1- Completely disagree 2 3 4 5- Completely agree

21. I have a clear idea of what it takes to achieve this goal.

1- Completely disagree 2 3 4 5- Completely agree

22. I know for myself when I get closer to achieving this goal.

1- Completely disagree 2 3 4 5- Completely agree

23. It is clear to me how I can achieve this goal.

1- Completely disagree 2 3 4 5- Completely agree

24. If I achieve this goal I will feel more competent.

1- Completely disagree 2 3 4 5- Completely agree

25. If I achieve this goal I will feel more satisfied.

1- Completely disagree 2 3 4 5- Completely agree

26. If I achieve this goal I will feel calmer.

1- Completely disagree 2 3 4 5- Completely agree

27. If I achieve this goal I will be less stressed.

1- Completely disagree 2 3 4 5- Completely agree

28. If I achieve this goal I will feel healthier.

1- Completely disagree 2 3 4 5- Completely agree

29. I feel happy when pursuing this goal.

1- Completely disagree 2 3 4 5- Completely agree

30. I enjoy working on this goal.

1- Completely disagree 2 3 4 5- Completely agree

31. I feel satisfied when I work on this goal.

1- Completely disagree 2 3 4 5- Completely agree

32. I feel anxious if I do not make progress towards this goal.

1- Completely disagree 2 3 4 5- Completely agree

33. I feel sad if I do not make progress towards this goal.

1- Completely disagree 2 3 4 5- Completely agree

34. I feel irritated if I do not make progress towards this goal.

1- Completely disagree 2 3 4 5- Completely agree

35. I ask others to help me to achieve this goal.

1- Completely disagree 2 3 4 5- Completely agree

36. I tell others about my progress towards this goal.

1- Completely disagree 2 3 4 5- Completely agree

37. I tell others how I aim to achieve this goal.

1- Completely disagree 2 3 4 5- Completely agree

38. I ask others for advice on how to achieve this goal.

1- Completely disagree 2 3 4 5- Completely agree

39. Do you have a partner?

Yes

No (Click "Next" at the bottom of the page and proceed to the next questionnaire)

40. My partner supports me in my pursuit of this goal.

1-Completely disagree 2 3 4 5-Completely agree

41. My partner does not feel involved with my goal.

1-Completely disagree 2 3 4 5-Completely agree

42. My partner encourages me to achieve this goal.

1-Completely disagree 2 3 4 5-Completely agree

43. My partner totally supports this goal.

1-Completely disagree 2 3 4 5-Completely agree

44. My partner makes it easier for me to attain this goal.

1-Completely disagree 2 3 4 5-Completely agree

45. My partner puts pressure on me to attain this goal.

1-Completely disagree 2 3 4 5-Completely agree

46. My partner gets cross if I make no effort to achieve this goal.

1-Completely disagree 2 3 4 5-Completely agree

47. My partner forces me to work on this goal.

1-Completely disagree 2 3 4 5-Completely agree

48. My partner disapproves of the way in which I pursue this goal.

1-Completely disagree 2 3 4 5-Completely agree

49. My partner works against my attainment of this goal.

1-Completely disagree 2 3 4 5-Completely agree

50. My partner wants me to give up this goal.

1-Completely disagree 2 3 4 5-Completely agree

For the following questions, please select the response that best represents you.

1. I intend to exercise several times a week.

Completely disagree Disagree Agree Totally agree

2. I intend to work up a sweat regularly.

Completely disagree Disagree Agree Totally agree

3. I intend to exercise regularly.

Completely disagree Disagree Agree Totally agree

4. I intend to be physically active regularly for a minimum of 30 minutes at least three times a week.

Completely disagree Disagree Agree Totally agree

5. I intend to increase my leisure time activity.

Completely disagree Disagree Agree Totally agree

6. I intend to adhere to the exercise regime prescribed to me during the rehabilitation.

Completely disagree Disagree Agree Totally agree

7. I have made a detailed plan regarding when to exercise.

Completely disagree Disagree Agree Totally agree

8. I have made a detailed plan where to exercise.

Completely disagree Disagree Agree Totally agree

9. I have made a detailed plan how to exercise.

Completely disagree Disagree Agree Totally agree

10. I have made a detailed plan how often to exercise.

Completely disagree Disagree Agree Totally agree

11. I have made a detailed plan with whom to exercise.

Completely disagree Disagree Agree Totally agree

12. I have made a detailed plan what to do if something interferes with my plans.

Completely disagree Disagree Agree Totally agree

13. I have made a detailed plan how to cope with possible setbacks.

Completely disagree Disagree Agree Totally agree

14. I have made a detailed plan what to do in difficult situations in order to act according to my intentions.

Agree

Completely disagree Disagree Totally agree

15. I have made a detailed plan which good opportunities for action to take.

Completely disagree Disagree Agree Totally agree

16. I have made a detailed plan when I have to pay extra attention to prevent lapses.

Completely disagree Disagree Agree Totally agree

The following questions refer to how you set exercise goals and plan exercise activities. Please indicate the extent to which each of the statements below describes you:

1. I often set exercise goals.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

2. I usually have more than one major exercise goal.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

3. I usually set dates for achieving my exercise goals.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

4. My exercise goals help to increase my motivation for doing exercise.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

5. I tend to break more difficult exercise goals down into a series of smaller goals.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

6. I usually keep track of my progress in meeting my goals.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

7. I have developed a series of steps for reaching my exercise goals.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

8. I usually achieve the exercise goals I set for myself.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

9. If I do not reach an exercise goal, I analyze what went wrong.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

10. I make my exercise goals public by telling other people about them.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

11. I never seem to have enough time to exercise.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

12. *Exercise is generally not a high priority when I plan my schedule.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

13. *Finding time for exercise is difficult for me.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

14. I schedule all events in my life around my exercise routine.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

15. I schedule my exercise at specific times each week.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

16. I plan my weekly exercise schedule.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

17. *When I am very busy, I don't do much exercise.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

18. Everything is scheduled around my exercise routine—both classes and work.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

19. I try to exercise at the same time and same day each week to keep a routine going.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

20. I write my planned activity sessions in an appointment book or calendar.

1-Does not describe 2 3-Describes moderately 4 5-Describes completely

For the following questions, please select the response that best represents you.

1. I exercise because other people say I should.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

2. I take part in exercise because my friends/family/spouse say I should.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

3. I exercise because others will not be pleased with me if I don't.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

4. I feel under pressure from my friends/family to exercise.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

5. I feel guilty when I don't exercise.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

6. I feel ashamed when I miss an exercise session.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

7. I feel like a failure when I haven't exercised in a while.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

8. I value the benefits of exercise.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

9. It's important to me to exercise regularly.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

10. I think it is important to make the effort to exercise regularly.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

11. I get restless if I don't exercise regularly.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

12. I exercise because it's fun.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

13. I enjoy my exercise sessions.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

14. I find exercise a pleasurable activity.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

15. I get pleasure and satisfaction from participating in exercise.

0 Not True For Me 1 2 True For Me 3 4 Very True for Me

Next, please choose your MOST IMPORTANT GOAL related to physical activity. The following questions refer ONLY to your MOST important goal. Please keep your most important goal in mind for the next set of questions.
Using the scale below each question, select the response that best describes your work on your goal.

1. I possess the necessary skills to attain this goal.

Not At All Slightly Moderately Very Much Extremely

2. I'm aware of my day-to-day behavior as I work toward this goal.

Not At All Slightly Moderately Very Much Extremely

3. I try not to let other goals interfere with this goal.

Not At All Slightly Moderately Very Much Extremely

4. I reward myself for working hard on this goal.

Not At All Slightly Moderately Very Much Extremely

5. Working toward this goal is exciting.

Not At All Slightly Moderately Very Much Extremely

6. This goal is valuable to me.

Not At All Slightly Moderately Very Much Extremely

7. I try to plan out in advance the steps necessary to reach this goal.

Not At All Slightly Moderately Very Much Extremely

8. I evaluate my progress on this goal by comparing myself to people who are also working on it, but are doing worse than I am.

Not At All Slightly Moderately Very Much Extremely

9. I have the necessary knowledge to reach this goal.

Not At All Slightly Moderately Very Much Extremely

10. Thinking about this goal gives me an uneasy feeling.

Not At All Slightly Moderately Very Much Extremely

11. I try not to let other people interfere with my work on this goal.

Not At All Slightly Moderately Very Much Extremely

12. This goal is worthwhile.

Not At All Slightly Moderately Very Much Extremely

13. I evaluate my progress on this goal by comparing myself to people who are also working on it, but are doing better than I am.

Not At All Slightly Moderately Very Much Extremely

14. I reward myself when I make progress toward this goal.

Not At All Slightly Moderately Very Much Extremely

15. I keep track of my overall progress toward this goal.

Not At All Slightly Moderately Very Much Extremely

16. This goal is important to me.

Not At All Slightly Moderately Very Much Extremely

17. The thought of not achieving this goal frightens me.

Not At All Slightly Moderately Very Much Extremely

18. I have what it takes to reach this goal.

Not At All Slightly Moderately Very Much Extremely

19. Working on this goal makes me feel happy.

Not At All Slightly Moderately Very Much Extremely

20. I evaluate my progress toward this goal in comparison to how well other people are doing in pursuing it.

Not At All Slightly Moderately Very Much Extremely

21. I treat myself to something special when I make progress toward this goal.

Not At All Slightly Moderately Very Much Extremely

22. I routinely criticize myself for unsatisfactory work toward this goal.

Not At All Slightly Moderately Very Much Extremely

23. Working toward this goal brings me joy.

Not At All Slightly Moderately Very Much Extremely

24. I tend to notice my successes while working toward this goal.

Not At All Slightly Moderately Very Much Extremely

25. This goal is meaningful to me.

Not At All Slightly Moderately Very Much Extremely

26. I carefully schedule my activities, so I have enough time to pursue this goal.

Not At All Slightly Moderately Very Much Extremely

27. This goal is a source of pleasure for me.

Not At All Slightly Moderately Very Much Extremely

28. When working on this goal, I criticize myself for not always having what it takes to succeed.

Not At All Slightly Moderately Very Much Extremely

29. I am on the lookout for potential obstacles that might interfere with my progress on this goal.

Not At All Slightly Moderately Very Much Extremely

30. Working on this goal makes me feel somewhat panicky.

Not At All Slightly Moderately Very Much Extremely

31. I have the ability to reach this goal.

Not At All Slightly Moderately Very Much Extremely

32. I evaluate my progress on this goal by comparing myself to people who are very much like me in terms of background and ability.

Not At All Slightly Moderately Very Much Extremely

33. I tend to criticize myself when I'm not making progress toward this goal.

Not At All Slightly Moderately Very Much Extremely

34. I am tense or jittery when working on this goal.

Not At All Slightly Moderately Very Much Extremely

35. I congratulate myself when things are going well on this goal.

Not At All Slightly Moderately Very Much Extremely

36. I routinely criticize myself if I don't work hard enough on this goal.

Not At All Slightly Moderately Very Much Extremely

People use various techniques to help them exercise on a regular basis. Recalling your physical exercise activities performed in the past 6 months, please answer the following questions regarding techniques you may have used to help you exercise.

On the scale provided next to each item, circle the number which best represents how often you used the specified technique in the past 6 months.

1. I mentally kept track of my exercise activities.

Never Rarely Sometimes Often Very Often

2. I mentally noted specific things which helped me exercise regularly.

Never Rarely Sometimes Often Very Often

3. I recorded my exercise activities in a written record.

Never Rarely Sometimes Often Very Often

4. I recorded my exercise activities in a written record including duration or intensity of exercise performed.

Never Rarely Sometimes Often Very Often

5. I kept a written record of specific methods used to enhance my ability to perform exercise.

Never Rarely Sometimes Often Very Often

6. I established goals for exercise time or distance (e.g. swim 20 minutes, run 3 miles).

Never Rarely Sometimes Often Very Often

7. I established short term goals (daily or weekly) related to how often I exercise.

Never Rarely Sometimes Often Very Often

8. I established exercise goals that focused on my health (e.g. improve fitness).

Never Rarely Sometimes Often Very Often

9. I established exercise goals that focused on my appearance (e.g. lose weight, tone body).

Never Rarely Sometimes Often Very Often

10. I established a written commitment with others to exercise regularly.

Never Rarely Sometimes Often Very Often

11. I established an oral commitment with others to exercise regularly.

Never Rarely Sometimes Often Very Often

12. I mentally set exercise goals.

Never Rarely Sometimes Often Very Often

13. I wrote down my exercise goals.

Never Rarely Sometimes Often Very Often

14. I exercised with someone to help me exercise regularly.

Never Rarely Sometimes Often Very Often

15. I exercised with a pet to help me exercise regularly.

Never Rarely Sometimes Often Very Often

16. I talked to someone while I exercised to help me exercise regularly.

Never Rarely Sometimes Often Very Often

17. I received verbal praise from someone for exercising.

Never Rarely Sometimes Often Very Often

18. I received a reward from someone for exercising.

Never Rarely Sometimes Often Very Often

19. I asked someone to remind me to perform exercise.

Never Rarely Sometimes Often Very Often

20. I asked someone to assume some of my responsibilities so I could exercise.

Never Rarely Sometimes Often Very Often

21. I asked someone for advice or demonstration of exercise activities.

Never Rarely Sometimes Often Very Often

22. I asked an exercise expert/health professional for advice or demonstration of exercise activities.

Never Rarely Sometimes Often Very Often

23. I placed exercise equipment in a prominent place to remind me to exercise.

Never Rarely Sometimes Often Very Often

24. I placed posters or pictures in a prominent place to motivate myself to exercise.

Never Rarely Sometimes Often Very Often

25. I wrote a note to remind myself to exercise.

Never Rarely Sometimes Often Very Often

26. I listened to music while I exercised.

Never Rarely Sometimes Often Very Often

27. I watched television while I exercised.

Never Rarely Sometimes Often Very Often

28. I read while I exercised.

Never Rarely Sometimes Often Very Often

29. I used home exercise equipment to help me exercise regularly.

Never Rarely Sometimes Often Very Often

30. I used a local exercise facility/club to help me to exercise regularly.

Never Rarely Sometimes Often Very Often

31. On trips away from home, I purposely stay at places which have access to exercise facilities.

Never Rarely Sometimes Often Very Often

32. I rewarded myself for exercising (e.g. snack, watch TV, movies, buy gift, etc.).

Never Rarely Sometimes Often Very Often

33. I rewarded myself for reaching health goals related to exercise (e.g. improve fitness).

Never Rarely Sometimes Often Very Often

34. I rewarded myself for reaching appearance goals related to exercise (e.g. lose weight, tone body).

Never Rarely Sometimes Often Very Often

35. I punish myself for not exercising (e.g. withhold reward if you don't exercise).

Never Rarely Sometimes Often Very Often

36. During exercise, I focused on how good I feel.

Never Rarely Sometimes Often Very Often

37. After I exercised, I focused on how good I felt.

Never Rarely Sometimes Often Very Often

38. I reminded myself of positive health benefits of exercise (e.g. improve fitness).

Never Rarely Sometimes Often Very Often

39. I reminded myself of how exercise makes me look better (e.g. lose weight, tone body).

Never Rarely Sometimes Often Very Often

40. I reminded myself of negative appearance consequences of not exercising (e.g. gaining weight).

Never Rarely Sometimes Often Very Often

41. I mentally scheduled time periods to exercise.

Never Rarely Sometimes Often Very Often

42. I wrote down specific time periods to exercise.

Never Rarely Sometimes Often Very Often

43. I rearrange my schedule of other activities to insure I have time to exercise.

Never Rarely Sometimes Often Very Often

44. If I had conflicts with my scheduled time periods for exercise, I chose to exercise.

Never Rarely Sometimes Often Very Often

45. I mentally noted barriers which influenced my ability to exercise.

Never Rarely Sometimes Often Very Often

46. I mentally planned ways to overcome barriers to my exercise activities.

Never Rarely Sometimes Often Very Often

47. I wrote down barriers which influenced my ability to exercise.

Never Rarely Sometimes Often Very Often

48. I wrote down ways to overcome barriers to my exercise activities.

Never Rarely Sometimes Often Very Often

49. I asked others to identify barriers to my exercise activities.

Never Rarely Sometimes Often Very Often

50. I purposely planned ways to exercise when I'm on trips away from home.

Never Rarely Sometimes Often Very Often

51. I purposely planned ways to exercise during bad weather.

Never Rarely Sometimes Often Very Often

Please, tell us what strategies you have you used in the past 2 months to successfully walk or do other exercise.

1. Set aside time each day to walk or do other exercise?

Never Seldom Occasionally Often Repeatedly

2. Make a plan to walk or do other exercise?

Never Seldom Occasionally Often Repeatedly

3. Keep or make a new plan based on how well you were doing with your walking or other exercise?

Never Seldom Occasionally Often Repeatedly

4. Set a goal for the number of days you walked or exercised each week?

Never Seldom Occasionally Often Repeatedly

5. Keep track of how many steps you take each day?

Never Seldom Occasionally Often Repeatedly

6. Keep track of the number of days you walked or exercised each week?

Never Seldom Occasionally Often Repeatedly

7. Keep track of how long your walks or exercise sessions were?

Never Seldom Occasionally Often Repeatedly

8. Plan to walk or exercise 5 days a week?

Never Seldom Occasionally Often Repeatedly

9. Plan to make your walking or exercise sessions a little longer?

Never Seldom Occasionally Often Repeatedly

10. Set goals for how long your walking or exercise sessions will be?

Never Seldom Occasionally Often Repeatedly

11. Plan your walking or other exercise sessions so they are enjoyable?

Never Seldom Occasionally Often Repeatedly

12. Get together with someone else to walk or do other exercise?

Never Seldom Occasionally Often Repeatedly

13. Keep track of how much you enjoy your walking or other exercise?

Never Seldom Occasionally Often Repeatedly

14. Keep track of how fast you walked or how hard you did other exercise?

Never Seldom Occasionally Often Repeatedly

For the following questions please select the best response that represents you.

1. I do things to make physical activity more enjoyable.

Never Rarely Some Times Often Very Often

2. I think about the benefits I will get from being physically active.

Never Rarely Some Times Often Very Often

3. I try to think more about the benefits of physical activity and less about the hassles of being active.

Never Rarely Some Times Often Very Often

4. I say positive things to myself about physical activity.

Never Rarely Some Times Often Very Often

5. When I get off track with my physical activity plans, I tell myself I can start again and get right back on track.

Never Rarely Some Times Often Very Often

6. I try different kinds of physical activity so that I have more options to choose from.

Never Rarely Some Times Often Very Often

7. I set goals to do physical activity.

Never Rarely Some Times Often Very Often

8. I make backup plans to be sure I get my physical activity.

Never Rarely Some Times Often Very Often

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

1 2

3 4

5 6

7

No Days --> Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

Hours per day	
Minutes per day	
Don't Know/Not Sure	

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

1 2

3 4

5 6

7

No Days --> Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?

Hours per day

Minutes per day

Don't Know/Not Sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

1 2

3 4

5 6

7

No Days --> Skip to question 7

6. How much time did you usually spend walking on one of those days?

Hours per day

Minutes per day

Don't Know/Not Sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?

Hours per day

Minutes per day

Don't Know/Not Sure

1. Would you like to receive class extra credit for this survey?

Yes

No

1. If you would like to receive extra credit for your participation please provide your first name, last name, and student identification number. (This information will remain confidential and will only be used for providing you with extra credit. This information will not be directly tied to the information you provided.)

First Name

Last Name

Student ID #

Thank you for participating in this study!!!

Appendix B—Items and factors for final measure

FACTOR 1 (Self-Regulation Self-Efficacy)

GAPI

11. Whatever happens, I will not give up this goal.

12. I am prepared to do an awful lot in order to reach this goal.

13. Even if this goal is difficult to attain, I will not give up on it.

14. I am determined to reach this goal.

15. This goal contributes to the attainment of other goals I have.

16. Working on this goal also contributes to other goals I have.

21. I have a clear idea of what it takes to achieve this goal.

22. I know for myself when I get closer to achieving this goal.

23. It is clear to me how I can achieve this goal.

24. If I achieve this goal I will feel more competent.

30. I enjoy working on this goal.

31. I feel satisfied when I work on this goal.

GSAB

2. I'm aware of my day-to-day behavior as I work toward this goal.

7. I try to plan out in advance the steps necessary to reach this goal.

19. Working on this goal makes me feel happy.

24. I tend to notice my successes while working toward this goal.

26. I carefully schedule my activities, so I have enough time to pursue this goal.

FACTOR 2 (Negative Affect)

GAPI

4. I pursue this goal because I would feel bad about myself if I didn't.

32. I feel anxious if I do not make progress towards this goal.

33. I feel sad if I do not make progress towards this goal.

34. I feel irritated if I do not make progress towards this goal.

GSAB

29. I am on the lookout for potential obstacles that might interfere with my progress on this goal.

MUL

6. I feel ashamed when I miss an exercise session.

7. I feel like a failure when I haven't exercised in a while.

FACTOR 3 (Goal Setting/Goal Planning)

HBS

1. Set aside time each day to walk or do other exercise?

2. Make a plan to walk or do other exercise?

3. Keep or make a new plan based on how well you were doing with your walking or other exercise?

4. Set a goal for the number of days you walked or exercised each week?

6. Keep track of the number of days you walked or exercised each week?

7. Keep track of how long your walks or exercise sessions were?

8. Plan to walk or exercise 5 days a week?

9. Plan to make your walking or exercise sessions a little longer?

10. Set goals for how long your walking or exercise sessions will be?

14. Keep track of how fast you walked or how hard you did other exercise?

MUL

10. I think it is important to make the effort to exercise regularly.

13. I enjoy my exercise sessions.

14. I find exercise a pleasurable activity.

15. I get pleasure and satisfaction from participating in exercise.

PETOSA

41. I mentally scheduled time periods to exercise.

43. I rearrange my schedule of other activities to insure I have time to exercise.

ROV

1. I often set exercise goals.

2. I usually have more than one major exercise goal.

3. I usually set dates for achieving my exercise goals.

4. My exercise goals help to increase my motivation for doing exercise.

6. I usually keep track of my progress in meeting my goals.

7. I have developed a series of steps for reaching my exercise goals.

12. *Exercise is generally not a high priority when I plan my schedule.

13. *Finding time for exercise is difficult for me.

14. I schedule all events in my life around my exercise routine.

15. I schedule my exercise at specific times each week.

16. I plan my weekly exercise schedule.

17. *When I am very busy, I don't do much exercise.

18. Everything is scheduled around my exercise routine—both classes and work.

19. I try to exercise at the same time and same day each week to keep a routine going.

SNIE

1. I intend to exercise several times a week.

2. I intend to work up a sweat regularly.

3. I intend to exercise regularly.

4. I intend to be physically active regularly for a minimum of 30 minutes at least three times a week.

FACTOR 4 (Goal Communications)

GAPI

35. I ask others to help me to achieve this goal.

36. I tell others about my progress towards this goal.

37. I tell others how I aim to achieve this goal.

38. I ask others for advice on how to achieve this goal.

HBS

12. Get together with someone else to walk or do other exercise?

ROV

10. I make my exercise goals public by telling other people about them.

FACTOR 5 (Factor was removed from final analyses)

GSAB

5. Working toward this goal is exciting.

15. I keep track of my overall progress toward this goal.

22. I routinely criticize myself for unsatisfactory work toward this goal.

36. I routinely criticize myself if I don't work hard enough on this goal.

PETOSA

33. I rewarded myself for reaching health goals related to exercise (e.g. improve fitness).

FACTOR 6 (Goal Setting/Outcome Expectancy)

DISHB

2. I think about the benefits I will get from being physically active.

PETOSA

6. I established goals for exercise time or distance (e.g. swim 20 minutes, run 3 miles).

7. I established short term goals (daily or weekly) related to how often I exercise.

8. I established exercise goals that focused on my health (e.g. improve fitness).

9. I established exercise goals that focused on my health (e.g. improve fitness).

12. I mentally set exercise goals.

37. After I exercised, I focused on how good I felt.

38. I reminded myself of positive health benefits of exercise (e.g. improve fitness).

39. I reminded myself of how exercise makes me look better (e.g. lose weight, tone body).

40. I reminded myself of negative appearance consequences of not exercising (e.g. gaining weight).

FACTOR 7 (Self-Monitoring)

PETOSA

3. I recorded my exercise activities in a written record.

4. I recorded my exercise activities in a written record including duration or intensity of exercise performed.

5. I kept a written record of specific methods used to enhance my ability to perform

exercise.

13. 13. I wrote down my exercise goals.

47. I wrote down barriers which influenced my ability to exercise.

48. I wrote down ways to overcome barriers to my exercise activities.

FACTOR 8 (Goal Planning)

SNIE

7. I have made a detailed plan regarding when to exercise.

8. I have made a detailed plan where to exercise.

9. I have made a detailed plan how to exercise.

10. I have made a detailed plan how often to exercise.

11. I have made a detailed plan with whom to exercise.

12. I have made a detailed plan what to do if something interferes with my plans.

13. I have made a detailed plan how to cope with possible setbacks.

14. I have made a detailed plan what to do in difficult situations in order to act according to my intentions.

15. I have made a detailed plan which good opportunities for action to take.

16. I have made a detailed plan when I have to pay extra attention to prevent lapses.