Distinguishing Perceived Competence and Self-Efficacy: An Example From Exercise

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Abstract

This paper examined the conceptual and statistical distinction between perceived competence and self-efficacy. Although they are frequently used inter-changeably, it is possible that distinguishing them might assist researchers in better understanding their roles in developing enduring adaptive behavior patterns. Perceived competence is conceived in the theoretical framework of self-determination theory (Deci & Ryan, 2002) and self-efficacy in the theoretical framework of social cognitive theory (Bandura, 1986). Purpose: The purpose of this study was to statistically distinguish perceived competence from self-efficacy for exercise. Method: Two studies evaluated the independence of perceived competence and self-efficacy in the context of exercise. Using two extant instruments with validity and reliability evidence in exercise contexts, the distinctiveness of the two constructs was assessed in two separate samples (n=357 middle aged sedentary adults; n=247 undergraduate students). Results: Confirmatory factor analysis supported the conceptual and empirical distinction of the two constructs. Conclusions: This study supports the conceptual and statistical distinction of perceived competence from perceived self-efficacy. Applications of these results provide rationale for more precise future theorizing regarding their respective roles in supporting initiation and maintenance of health behaviors.

Key words: exercise, factorial validity, motivation, need satisfaction.

Distinguishing Perceived Competence and Self-efficacy: An Example from Exercise

Regular exercise is foundational to the maintenance of good health as well as rehabilitation and regulation of many disease conditions including coronary vascular disease, and type 2 diabetes (Bouchard, Blair & Haskell, 2007; Katzmarzyk, Church & Blair, 2004; Katzmarzyk & Janssen, 2004; Katzmarzyk, Janssen & Ardern, 2003). Public health practitioners are concerned with better understanding motivation to engage in regular exercise (e.g., Bauman, Nelson, Pratt, Matsudo, & Schoeppe, 2006; Bleich, & Sturm, 2009; Cavill & Bauman, 2004; Prohaska, Belansky, Belza, Buchner, Marshall, McTigue, Satariano, & Wilcox, 2006; Rychetnik, Bauman, Laws, King, Rissel, Nutbeam, Colagiuri, & Caterson, 2012). Social cognitive approaches to motivation for exercise all include some consideration of perceived capability to perform the focal behavior. The extent to which these conceptions of capability are distinguishable however is the topic of some debate. Theoretically and practically, it seems necessary to disentangle different conceptualizations because too many redundant variables clutter the literature, yet clearly distinguishable variables can contribute to a more fully explicated understanding of human behavior (Biddle, 2006; Forscher, 1963; Zhu, 2000). The idea that people need to perceive they are capable of performing a focal health behavior before they can be expected to adopt it seems logical. Self-determination theory (Deci & Ryan, 2000), and self-efficacy theory (Bandura, 1977; 1986; 1997) both include such a variable at a fundamental level.

Self-determination theory (SDT) posits that motivation arises from the satisfaction of basic psychological needs (Deci & Ryan, 2000). The theory adopts an organismic dialectic, that humans engage in interesting activities, exercise capacities, pursue social connectedness, and try to integrate intra-psychic and interpersonal experiences (Deci & Ryan, 2002). In SDT, “needs

specify innate psychological nutriments that are essential for ongoing psychological growth, integrity, and well-being" (Deci & Ryan, 2000, p. 229). Three psychological needs are proposed: competence, autonomy, and relatedness. Consequently, SDT argues that people will choose goals, behavioral domains, and relationships that satisfy the psychological needs. It is the need for competence that is relevant here, which is the need to master personally challenging tasks. An important characteristic of the need for perceived competence is personal effectance (White, 1959), or the need to effect change on the environment and attain valued outcomes. Personal effectance distinguishes tasks that will satisfy the need for competence from other mundane, trivial, or personally meaningless tasks, the performance and mastery of which would not be expected to satisfy the need. In this sense, competence is more than merely some 'ability' to perform a task, and includes consideration of the personal importance of the task.

Self-efficacy, the key construct in social cognitive theory (SCT; Bandura, 1986), is defined as situation specific self-confidence. In contrast with the SDT conception of perceived competence as a need to master personally challenging tasks, self-efficacy ". . . refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). In SCT, Bandura (1997) also eschews the idea that self-efficacy is confidence for performing trivial behaviors that comprise only a part of a larger, goal directed, set or sequence of behaviors, that must be performed in socially challenging conditions. Self-efficacy is theorized to influence successful execution of behaviors under differing social circumstances, and the sub-skills that comprise a course of action cannot, therefore, be decontextualized and retain any meaningfulness or predictive utility. Self-efficacy is not purported to relate to the quality of the behavioral experience or outcomes, only to behavioral persistence, which it is said to enhance. Bandura (1997) is careful to distinguish self-efficacy

from expected outcomes, indicating that self-efficacy relates to confidence for performing the behavior, but that outcome expectations are the likely consequences of the behavioral performance. Self-efficacy does not address the expected consequences of successful completion of the behavior, only whether the performer feels he/she can execute the behavior in the given circumstances. Because of its lack of consideration of expected outcomes, Deci and Ryan (2000) describe self-efficacy as a "rather simplistic conceptualization of agency" (p. 257). SCT includes no claims about the association of self-efficacy with identity or 'self-congruence'. So, one can be efficacious (or not) about things that are not congruent with one's sense of self and there are no purported consequences of this state that are relevant to SCT. SCT is specific, however, that perceptions of self-efficacy will only motivate behavior when the necessary skills and incentives are already in place (Bandura, 1986). It is plausible, therefore, that both self-efficacy and satisfying the need for competence might independently relate not only to behavioral persistence, but also the motivational consequences of the behavioral persistence. From the perspective of construct validation (cf. Messick, 1989) and development of a nomological network (Cronbach & Meehl, 1955) around the idea of health behavior persistence, it is important to determine whether these conceptually similar, yet distinct, constructs can be statistically separated, and therefore might contribute independently to our understanding of a focal behavior, in this case, exercise. The principle of the multi-method matrix (cf. Zhu, 2000) can also be helpful in the pursuit of construct validity.

Maddux (1986) endorsed a finer conceptualization of self-efficacy to include task self-efficacy (confidence for performing the elemental aspects of a behavior) and coping self-efficacy (confidence for performing the behavior under challenging circumstances). This finer conceptualization allows for the distinction of the basic task performance from the circumstances

of performance, and enables researchers to address the issue, central to the conceptualization of self-efficacy, that it is not the skills one possesses, but what one can do with them in challenging circumstances (Bandura, 1997). Thus, contemporary measurement of self-efficacy in exercise reflects these two sub-domains, that seem particularly relevant to exercise, where one must be confident that s/he can perform the basic skills, and must also be confident that s/he can manage daily circumstances in order to achieve the frequency of exercise recommended for health. Coping has been further split into considerations of barrier self-efficacy, and scheduling self-efficacy (McAuley, Jerome, Marquez, Elavsky & Blissmer, 2003; Motl et al., 2005; Scholtz, Dona, Sud & Schwarzer, 2002; Schwarzer & Renner, 2000), which is specific to only time-related barriers to exercise. Scheduling self-efficacy has also been suggested as an important behavioral sub-set over which a person must have confidence in order to exercise regularly, as opposed to performing a single exercise bout (Rodgers et al., 2008; Scholz et al., 2005).

The construct of perceived competence in SDT seems to most closely relate to the idea of task self-efficacy (Maddux, 1986). Whether or not perceived competence for exercise, as conceptualized in SDT, can be distinguished from any of the three types of self-efficacy for exercise, but particularly task-self-efficacy, is unknown. If the two can be separated, then finer theoretical hypotheses regarding how best to support initiation, and more importantly, adherence to exercise can be developed. SDT and SCT are quite clear on distinct means of enhancing their respective key constructs.

There are some points of theoretical congruence between SDT and SCT that concern the basic psychological need to feel competent and perceived self-efficacy. First, both constructs contribute to goal pursuit and attainment. Second, both are “generative” in the sense that they promote behavioral engagement, learning, and skill acquisition. Neither one is an outcome per

se. Both are conceptually distinguished from behavioral outcomes and both are conceptualized as processual in nature – meaning they support behavioral persistence and develop over time and exposure to relevant experiences. Finally, both are cyclical in the sense that when one's need for perceived competence is met, or when one feels self-efficacious in a particular behavioral domain, each is strengthened and therefore the likelihood of performing the associated behavior again is enhanced. However, it is clear that one can be efficacious for behaviors that do not satisfy the need for competence and so self-efficacy and perceived competence should not be redundant to each other.

Both SDT and SCT are important theories in the psychology and health psychology literatures. Self-efficacy has been found to have robust associations with behavior across a variety of domains (Bandura, 1997). Similarly, the tenets of SDT have been upheld in many domains, and, additionally, the quality of motivation has been demonstrated to be associated with not only behavioral outcomes (Mullan & Markland, 1997; Wilson, Rodgers, Fraser, & Murray, 2004), but also with personal well-being (Edmunds, Ntoumanis, & Duda, 2007; Wilson, Longley, Muon, Rodgers, & Murray, 2006). Overall, there is no strong reason to expect that either construct, self-efficacy or perceived competence, should be rendered redundant by the other in their respective associations with behavior, yet they are frequently used inter-changeably.

Only a few studies have examined self-efficacy and aspects of SDT theory together. For example, Senecal, Nowen and White (2000) examined self-efficacy and autonomous self-regulation in the context of diabetes self-care and found them to exert independent influences on adherence (primarily related to self-efficacy), and well-being (primarily related to autonomy). Sheldon and Elliot (1999) developed a self-concordance model and found that needs satisfaction

mediated relationships between performance of a behavior and positive psychological outcomes, independent of task self-efficacy. However, the measurement of self-efficacy utilized by Sheldon and Elliot is arguably more representative of outcome expectancy, (i.e., "how well do you expect to do"), than Bandura's (1986) notion of self-efficacy per se. Finally, in a meta-analysis of correlates of girls' participation in physical activity, Biddle, Whitehead, O'Donovan, and Nevill (2005) found separate associations of perceived competence and self-efficacy, but provided little detail on the operationalization of these constructs, and they do not appear to have been assessed together in the same studies. Such findings lend some support to the idea that self-efficacy and SDT-related constructs are likely to be related, but not isomorphic, with respect to health behaviors.

Exercise is an interesting behavioral domain within which to examine this issue for a variety of reasons. First, regular exercise has been robustly associated with positive physical and mental health (Katzmarzyk et al., 2003). In general, it is a behavior that public health agencies (world-wide) encourage. It has been demonstrated that a rather large majority of people do not exercise enough to accrue optimal health benefits (Katzmarzyk, Gledhill & Shephard, 2000). From a behavioral perspective, the basic sub skills comprising "regular exercise" are not trivial – meaning they are not as simple or brief as brushing one's teeth, for example. Exercise can be difficult, and managing the rest of one's life to include regular exercise also requires the organization and execution of multiple sub-sets of skills, ranging from joining an exercise facility (or club), remembering to pack the required gear and clothing, and negotiating the sport or fitness class social etiquette. Also, one might feel over-challenged (that the exercise is too hard); and disconnected with the others in the context (especially if the others seem more proficient by comparison). Furthermore, the immediate outcomes of exercise are not necessarily

positive; they can include short-term discomfort (e.g., muscle soreness), unpleasant social experiences (feeling out of place and/or excluded), uncomplimentary self-referent thought and some negative affect (Lind, Vazou, & Ekkekakis, 2008). These outcomes are believed to eventually be replaced with more positive counterparts over time. None-the-less, population health would be enhanced if more people did more exercise (Blair & Morris, 2009; Haskell, Blair, & Hill, 2009; Pratt, Epping, & Dietz, 2009; Prohaska et al., 2006). In order to determine if the distinction between perceived competence and self-efficacy is robust to their theorized generative and processual nature, it is key to assess the distinction in populations differing in their experiences with exercise.

Recently, Wilson, and colleagues formulated and tested the Psychological Need Satisfaction in Exercise (PNSE) scale in the theoretical traditions of SDT (Wilson, Rogers, Rodgers, & Wild, 2006**).** This scale assesses the extent to which the three psychological needs (competence, autonomy and relatedness) are fulfilled in exercise contexts, and conceptually and empirically distinguishes between them. Wilson et al. (2006) demonstrated the factorial validity of the PNSE using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), with excellent fit indices (CFI$\geq$ 0.92, IFI$\geq$0.92, and SMSR $\leq$ 0.08), and internal consistency score reliability estimates greater than or equal to 0.90 for the three subscales. Also recently, Rodgers and colleagues developed and assessed the multidimensional self-efficacy for exercise scale (MSES) in the theoretical tradition of SCT (Rodgers, Wilson, Hall, Fraser & Murray, 2008). This scale assesses three behavioral sub-domains of self-efficacy associated with regular exercise behavior: task (confidence for performing the elemental aspects of the behavior), coping (confidence for overcoming non-time related barriers to regular exercise behavior) and scheduling (confidence for regularly including exercise into one's schedule). Using EFA and

then CFA, Rodgers et al. (2008) demonstrated excellent factorial validity (CFI =.99; NFI=.99, and RMSEA=.08), and Cronbach's alphas ranging from 0.81 to 0.84. Both scales are designed to yield three subscale scores, and not an overall score. Both instruments are based on multidimensional conceptualizations of psychological need satisfaction and types of self-efficacy, respectively, that allow for determining which needs or types of self-efficacy might be relevant to a certain behavioral context. Both of these instruments have psychometric evidence of validity and reliability in exercise contexts and so afford us the opportunity to examine the distinction between the multiple forms of exercise self-efficacy measured by the MSES and perceived competence assessed by the PNSE, the latter within the theoretical and measurement context of the other two needs. This is important because, to compare constructs, measurement and associated tests should be comparable in terms of context and scope (Bandura, 1977; Manstead & van Eekelen, 1998). According to the multi-trait multi-method approach to validity testing, the subscales for self-efficacy should correlate more strongly with each other than with the needs satisfaction subscales, and vice-versa (cf. Zhu, 2000) if they are statistically distinct.

The purpose of this paper was to examine the measurement properties of instruments assessing perceived competence for exercise and self-efficacy for exercise to determine whether they can be empirically distinguished. To achieve this purpose, two studies were undertaken with distinct samples. The variables of interest, self-efficacy and perceived competence, were operationalized as they have been represented in the two instruments, the MSES (Rodgers et al., 2008), and the PNSE (Wilson et al., 2006). In order to preserve the psychometric characteristics of the subscales as originally posited, the entire instruments were used, and, therefore, all three subscales for each instrument were included.

Study One

Method

Participants

A sample of 357 adults volunteering to take part in a research based exercise program participated in this study. These volunteers were self-identified as “healthy sedentary adults”, and lived in the community surrounding a large university in western Canada. There were 86 men, 268 women (3 people did not report their sex), their mean age was 44.23 years (SD = 15.17 years), mean body mass index was 30.93 kg/m^2 (SD = 6.72 kg/m^2), indicating that, on average, the sample was overweight (BMI >25 kg/m^2 but < 30 kg/m^2) or obese (BMI ≥ 30 kg/m^2). Only 18% of the sample had BMI<25 kg/m^2, and 50% had BMI>30 kg/m^2. Their current physical activity levels were assessed using the Godin Leisure Time Exercise Questionnaire (Godin & Shepherd, 1985). This instrument assesses the frequency of 15 minute bouts of mild, moderate, and strenuous exercise. Using an algorithm, METS (total energy expenditure score) can be calculated. The average METS for this sample was 13.07 (SD=15.17) which corresponds to about two 15-minute sessions of mild exercise, about one 15-minute session of moderate exercise, and no strenuous exercise, each week. This sample arguably represents the population of interest to health promoters: they are middle aged, insufficiently active, and overweight. Unfortunately, the sample is unbalanced in terms of gender, but this is typical of exercise studies where it is difficult to recruit male participants. This is a limitation of the reported sample, however, gender invariance was reported for both the PNSE and the MSES in previous studies (Rodgers et al., 2008; Wilson et al., 2006) in comparable samples where score reliability and validity evidence have been rigorously tested.

Procedures

All study procedures were approved by a University Research Ethics Board. The volunteer participants attended information meetings in groups of 25 to 30 individuals in classroom settings at the University where they gave informed consent for the questionnaire data reported here, that subsequently comprised the baseline data for an intervention study that was offered following these questionnaires.

Measures

Psychological Needs Satisfaction in Exercise PNSE (Wilson et al., 2006). This is an 18 item self-report instrument assessing the degree of fulfillment associated with the psychological needs for competence, autonomy and relatedness posited by Deci and Ryan (200) within exercise contexts. Wilson et al. (2006) have previously reported strong validity evidence using EFA and CFA procedures plus a systematic review offers comprehensive support for the reliability and validity of PNSE scores (Wilson, Mack, Gunnell, Oster, & Gregson, 2008). Participants respond on 6-point Likert type scales anchored with 1=false and 6=true. Item descriptions, distributional characteristics and internal consistency estimates are presented in Table 1. Subscale scores were calculated by taking the average of the 6 scored items per subscale (Morris, 1979).

Multidimensional Self-efficacy for Exercise Scale (MSES; Rodgers et al., 2001; 2002a; 2002b; 2008) is a 9 item self-report instrument representing three behavioral domains of self-efficacy believed to be important for adoption and maintenance of exercise. Participants responded to each item on a 100% confidence scale broken into eleven 10% intervals ranging from 0% (“I have no confidence”) to 100% (“I have complete confidence”). The three domains are task, scheduling, and coping self-efficacy for exercise. Rodgers et al. (2008) demonstrated strong factorial validity using both EFA and CFA. Brief descriptions of the items, their

distributional characteristics, and internal consistency of the factors are presented in Table 1. Subscale scores were calculated by averaging the three MSES items per subscale (Morris, 1979).

Data Analysis

In order to determine whether the factors of interest, task, scheduling, and coping self-efficacy for exercise and perceived competence in exercise contexts could be empirically distinguished from each other the factor structure underlying the items comprising the PNSE and the MSES was examined using confirmatory factor analysis (CFA) using Mplus 7.11 (Muthén & Muthén, 2012). CFA was selected because the purpose was to confirm the distinction among the variables comprising the two scales which were already independently supported by factor analytic evidence. Even though there was no intention to examine the autonomy and relatedness subscales of the PNSE, they were retained for the assessment of the factorial structure to replicate the original structure proposed by Wilson et al. (2006) and to retain the consideration of satisfaction of the need for competence within its original theoretical context. A single six factor model comprising the three MSES subscales and the three PNSE subscales was specified. It was also anticipated that the variance shared between the three self-efficacy subscales of the MSES and the perceived competence subscale of the PNSE would be small, indicating their relative independence. In order to assess this, the average variance extracted (AVE) for the self-efficacy scales were calculated. The AVE is the average amount of variance in a set of indicators explained by their latent variable and can be used to assess the discriminant validity of latent variables (Fornell & Larcker, 1981). According to Fornell and Larcker (1981), the AVE for a latent variable should be greater than the variance shared between the variable and other latent variables in the model. Thus, discriminant validity is satisfied when a latent variable's AVE is greater than the squared bivariate correlations between it and other latent variables in the model.

Therefore, we compared the AVEs for the three self-efficacy scales with their squared bivariate correlations with perceived competence.

The distribution of the variables violated the assumption of multivariate normality (Mardia's coefficient = 30.21). The MLR estimator was used to deal with non-normality and the missing data (14% of scores). MLR is an option in Mplus for maximum likelihood estimation with robust standard errors. This estimator is a full information maximum likelihood estimator of missing data, parameter estimates, and standard errors, with a chi-square test statistic that is robust to non-normality and is asymptotically equivalent to the Yuan-Bentler T2* test statistic (Muthén & Muthén, 2012). This test statistic has been shown to more closely approximate the χ^2 distribution than the uncorrected statistic and to have more trustworthy standard errors when distributional assumptions are violated (Yuan & Bentler, 2000). In addition, model fit was determined by a combination the following tests and cut-off values: comparative fit index (CFI) ≥ .90, the root mean square error approximation (RMSEA) ≤ .08, and standard root mean square residual (SRMR) ≤ .08 (Kline, 2011).

Results

The CFA yielded an acceptable fit of the model: $\chi^2_{309} = 592.29$, $p<.001$; RMSEA = .055, 95% CI [.048, 061]; CFI = .941; SRMR = .047. The distributional characteristics, are presented in Table 1. Kline (2011) suggests that both the standardized and unstandardized coefficients assist with interpreting the results. The standardized coefficients can be interpreted as the estimated correlation between the indicator and its' factor, whereas the unstandardized coefficients are interpreted as regression coefficients. Kline suggests that reporting only standardized coefficients makes it "…difficult to compare the results to those from later studies where either the same or a similar model is estimated in different samples" (p. 363). When

comparing results across two samples, it is wise to also consider the unstandardized coefficients. Table 2 shows both the standardized and unstandardized coefficients. Figure 1 shows the final model with the standardized coefficients. Standardized factor coefficients ranged from .67 to .93. Table 3 shows the correlations among the factors and the reliability estimates that denote minimal error of measurement in these scores for this sample. The correlations should be interpreted in terms of effect size and not exclusively probability values due to the large sample size in this study (cf. Cohen, 1992; Zhu, 2012). The three self-efficacy scales were significantly, but only moderately, correlated with perceived competence and shared a maximum of 17% of variance. The AVEs for task, coping and scheduling self-efficacy were .78, .75 and .86 respectively and considerably greater than the squared bivariate correlations between the self-efficacy scales and perceived competence (.13, .18, and .11, respectively), indicating good discriminant validity between the self-efficacy scales and perceived competence (cf. Zhu, 2000).

Study Two.

The purpose of Study 2 was to replicate Study 1 by re-examining the factor structure underpinning the two instruments in a new sample. A different sample was selected to achieve greater generalizability of the findings. All samples have different sources of bias relating to demographic characteristics, sampling methods, and behavioral characteristics that can independently or collectively influence scores on instruments like the MSES and PNSE (Crocker & Algina, 1986). Both social cognitive theory and self-determination theory purport to have broad generalizability. Assessment of the relationships in a different type of sample will give greater confidence to the inferences regarding the distinction of these variables by creating multiple lines of evidence (cf. Messick, 1989), and supporting the multi-trait, multi-method matrix approach.

Participants

A sample of 246 undergraduate student volunteers (males= 71, females = 173; mean age 19.96 years (*SD*=2.93) from a large university in western Canada completed the questionnaire. They reported adequate activity levels 43.32(23.01) METS (Godin & Shephard, 1985), and BMI of 22.52 (3.19) kg/m^2, well within the healthy range of 20 – 25 kg/m^2.

Procedures

Students attending a large multi-faculty health education class were invited to volunteer to participate in a study regarding health beliefs and behaviors. All study procedures were approved by a University Research Ethics Board. After providing informed consent, students completed a questionnaire package including the variables of interest as well as other health related questions during class time on two occasions separated by two weeks. Only the data from the first assessment time are reported here. The questionnaires took five to ten minutes to complete. Questionnaires were distributed and collected by the researchers who also answered any questions students had during the procedure.

Measures

Psychological Needs Satisfaction in Exercise PNSE (Wilson et al., 2006). This is the same 18 item scale used in Study 1 to assess the three psychological needs for exercise, namely perceived competence, autonomy and relatedness.

Multidimensional Self-Efficacy for Exercise Scale (MSES) (Rodgers et al., 2001, 2002a, 2002b, 2008). This was the same 9 item scale representing three behavioral domains of self-efficacy as used in Study 1, namely task, scheduling, and coping efficacy.

Analysis and Results

To confirm the findings of Study 1, a CFA was conducted using Mplus 7.11 (Muthén & Muthén, 2012). As in Study 1, it was expected that a six factor model comprising the three MSES subscales and the three PNSE subscales would provide an acceptable fit to the data and that the average variance extracted (AVE) for each of the three self-efficacy subscales of the MSES would be greater than the variance they shared with the perceived competence subscale of the PNSE. The distribution of the variables violated the assumption of multivariate normality (Mardia's coefficient = 18.76), and so the MLR estimator was used to deal with the non-normality and the missing data (2% of scores). The same criteria as Study 1 were applied.

The CFA yielded an acceptable fit of the model: Satorra-Bentler $\chi^2_{309} = 650.297$, $p<.001$; RMSEA = .067, 95% CI [.060, .074]; CFI = .911; SRMR = .053. Factor loadings ranged from .66 to .91. Table 2 shows both the standardized and unstandardized coefficients. Figure 2 shows the final model and the standardized coefficients. Table 4 shows the correlations among the factors and their internal consistencies. Internal consistency score reliability coefficients in this sample show limited evidence of error in the observed scores. The correlations between the self-efficacy scales and perceived competence were greater than in Study 1. However, they shared a maximum of only 38% variance. Furthermore, the AVEs for task, coping and scheduling self-efficacy were .70, .66 and .70 respectively and considerably greater than the squared bivariate correlations between the self-efficacy scales and perceived competence (.34, .38 and .31 respectively), indicating evidence of discriminant validity between the self-efficacy measured by the MSES and perceived competence assessed by the PNSE.

Discussion

The purpose of this paper was to conceptually and empirically distinguish the concepts of perceived competence for exercise and self-efficacy for exercise in two different samples. In

order to avoid offering theoretically de-contextualized consideration of perceived competence and task self-efficacy, the measurement distinction included consideration of current conceptualizations of all three psychological needs and all three domains of self-efficacy, thereby preserving the measurement parameters of the instruments from which the two constructs of central interest were drawn.

In Studies 1 and 2, confirmatory factor analyses and examinations of the amount of shared variance among and between the constructs revealed empirical distinctions at the level of construct measurement, suggesting that perceived competence for exercise and three kinds of exercise self-efficacy are not redundant to each other as conceptualized in the PNSE (Wilson et al., 2006) and the MSES (Rodgers et al., 2008).

It is important to recognize that the two constructs, as used here, come from different theoretical frameworks that are formulated on distinct assumptions. In this study, the use of the constructs is similar regarding performance of regular exercise, which facilitates a useful comparison between them. They are conceptualized differently, one at the level of the person (perceived competence) and one at the level of the behavior (self-efficacy). They are also purported to play different roles in human functioning, and in the production of behavior, and so we do not expect them to have redundant relationships with behavior or other outcomes even though they are likely to be related, emerging as they do, from past experiences. However, this study is limited in terms of examination of behavioral outcomes. Whereas SDT specifically postulates that satisfaction of the psychological needs will lead not only to behavioral persistence, but also to more positive psychological sequelae (e.g., Deci & Ryan, 2000; Sheldon et al, 2004), Deci and Ryan (2000) have been very specific that the need for perceived competence is unlikely to be associated with behavioral persistence unless the need for

autonomy is also met. Self-efficacy, in contrast, is purported only to be related to behavioral persistence. Basically, according to SCT, we are more likely to perform behaviors for which we feel efficacious than behaviors for which we do not. This effect of self-efficacy on behavioral adherence has been robust in previous exercise research, as well as in other domains (e.g., Bandura, 1997; McAuley et al., 2003; Rodgers et al., 2008; Scholtz et al., 2002).

In Study 1, the data set was drawn from individuals who considered participation in a research based exercise program, thus the sample is, in terms of motivation, more heterogeneous than in studies where only those who chose to participate in the full program provide responses. Similarly, Study 2 includes individuals from a health education class, who were not recruited to participate in any form of exercise at all. Study 1 provides us with a large sample of adults considering (but not necessarily actually) becoming more physically active in which to test our hypotheses that perceived competence for exercise and self-efficacy for exercise will be distinguishable from one another. Study 2 comprises undergraduate students. The Study 2 sample is much more homogenous in age and life stage than Study 1, who also have a healthy BMI and adequate activity levels. Thus, it is not surprising that there are stronger relationships among the variables in the Study 2 sample compared to the Study 1 sample. This provides greater confidence in the findings that support differences between self-efficacy and perceived competence.

Two theoretical questions arise as a result of these studies. First, which (self-efficacy or perceptions of competence) comes first? It seems unreasonable not to consider that feeling efficacious over a particular set of behaviors might increase the probability that successfully performing those behaviors will also satisfy our need for competence. However, it also seems possible that if one is efficacious over meaningless or extrinsically motivated behaviors, one

might persist, but the need for competence might not be met (Deci & Ryan, 2000). Behavioral specific longitudinal research is necessary to address this question. Understanding that self-efficacy and perceived competence cannot be used interchangeably allows future researchers to explore such questions. A second question of interest also emanates from this study, namely how are behavioral persistence and psychological outcomes of behavior influenced when only one of the two constructs is positively associated with the behavioral performance? That is, if one is efficacious for performing a behavior that does not fulfill the need for competence, does the latter thwart persistence? Conversely, it will also help us to understand why people persist with undesirable health-related behaviors. It has been noted that many health-related behaviors are unlikely to be inherently enjoyable (Wilson et al. 2004), and that performing them because of a belief in their importance for health might be the best we can expect. For example, many people do not enjoy exercise (or flossing their teeth, as another example) but do so because they are convinced of the personal health value of doing so. A practical consideration might be whether or not development of self-efficacy for the tasks required to achieve the behavioral goal might be a useful step in developing task-persistence followed by developing more self-determined motivation. There is a growing literature addressing the importance of autonomy support in the production of positive behavioral outcomes (Williams, 2002; Ryan, Patrick, Deci, & Williams, 2008). However, in the health domain, we are very often interested in producing only the behavioral outcomes regardless of the quality of the motivation underpinning those behaviors. For example, why women seek cervical screening is of little concern as long as they do so as an ongoing preventative health activity. From a SDT perspective however, if the behavioral goals can be made to be more self-congruent and produced from a more self-determined motivational foundation, then we would expect not only better behavioral persistence, but better additional

sequelae such as positive well-being (Edmunds, et al., 2007). These concerns seem particularly germane to behaviors one must perform regularly, like exercise and dietary intake, as opposed to screening behaviors that need only be performed once per year or less. Perhaps, similar to the work of Senecal et al. (2000), self-efficacy should be regarded as a complementary construct to the three psychological needs and methods of incorporating the development of self-efficacy as a practical means of also optimizing psychological need satisfaction might produce manageable intervention strategies to increase exercise behavior. Self-efficacy is probably sufficient to produce behavioral attempts (or initiation), but the independent effects of the two constructs might help us to understand why it is that even when people have high task-self-efficacy for a behavior, such as exercise, they still do not necessarily engage in that behavior, as noted by Rodgers and Sullivan (2001).

The relevant strengths of the present studies include the large sample sizes, the ecological validity of the first sample, and the congruence of the two instruments regarding the behavior used across Study 1 and 2. There are also some weaknesses that need to be considered in the interpretation of these data including the imbalance of men and women in both samples and the lack of association to behavioral indicators. However, because the main purpose of the study was theoretical, the data do give us confidence in concluding that perceived competence for exercise and exercise self-efficacy are not redundant constructs and it would be fruitful to examine how they work in concert to support enduring exercise behaviors.

Understanding different components of motivation is difficult because many of the constructs appear very similar to each other. There is a proliferation of constructs addressing people’s perceptions of whether or not they can carry out a behavior. One of these is a person’s perception of basic capability of carrying out a behavior, or what is termed perceived

competence in the self-determination theory literature. Another one is self-efficacy (Bandura, 1986). Bandura indicates that self-efficacy is more than the basic capability for carrying out a behavior, specifically, it is one's confidence that they can carry out the behavior under challenging circumstances. Conceptually, they are theorized to be different, and our careful psychometric analysis supports this distinction at the level of measurement. Knowing they are different gives plausible future research directions such as determining which one needs to come first, and how each independently influences sustained performance of health behaviors. Knowing they are different also discourages researchers from using the two constructs interchangeably, and might assist with de-cluttering the literature in this regard.

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Table 1.

Distributional characteristics and CFA (Full Information Maximum Likelihood) standardized solution for MSES and PNSE in Study 1

Latent Factor Labels and item abbreviations	*M*	*SD*	*Skew*	*Kurt*
Task Efficacy				
complete exercise using proper technique	84.11	15.96	-1.92	5.21
follow directions to complete exercise	89.91	13.34	-2.65	10.50
perform all of the required movements	85.33	15.00	-1.82	5.34
Coping Efficacy				
exercise when you feel discomfort	76.42	18.31	-1.44	2.89
exercise when you lack energy	74.75	27.15	-1.13	1.94
exercise when you don't feel well	68.13	20.65	-.91	1.04
Scheduling Efficacy				
include exercise in your daily routine	79.18	18.16	-1.59	3.89
consistently exercise 4 times per week	77.77	19.72	-1.47	-0.74
arrange schedule to include regular exercise	78.54	19.28	-1.55	3.19
Perceived Competence				
feel I am able to complete exercises	4.34	1.14	-.82	.91
can do even most challenging exercises	3.78	1.36	-.43	-.26
confident in ability to perform exercises	4.26	1.16	-.89	.96
capable of completing exercises	4.39	1.17	-1.04	.96
capable of doing even most challenging	3.83	1.37	-.49	-.31
feel good about way I am able to complete	4.25	1.2	-.95	1.10
Perceived Autonomy				
feel free to exercise my own way	4.74	.99	-1.01	1.91
feel free to make my own ex.decisions	4.56	1.21	-1.10	1.32
feel like I am in charge of my exercise	4.64	1.13	-1.20	2.02
feel like I have a say in choosing exercise	4.81	1.03	-1.33	2.89
feel free to choose which exercises	4.87	1.02	-1.15	2.07
feel like I am the one who decides	4.71	1.12	-1.15	1.83
Perceived Relatedness				
feel attached to ex companions who accept me	3.37	1.56	-.18	-.91
share a common bond with people	3.80	1.47	-.58	-.39
feel a sense of camaraderie with ex companions	3.86	1.40	-.75	-.03
feel close to ex companions . . .difficult ex	3.7	1.40	-.62	-.15
feel connected to people who I ex with	3.93	1.33	-.78	.23
feel I get along well with other exercisers	4.41	1.20	-1.20	1.96

Note. *M* = Mean; *SD* = Standard Deviation; *Skew*. = Skewness; *Kurt*. = Kurtosis

Table 2.

CFA (Full Information Maximum Likelihood) standardized and unstandardized coefficients for MSES and PNSE in Study 1 and 2

	Study 1				Study 2			
Latent Factor Labels and item abbreviations	β	*SE*	B	*SE*	β	*SE*	B	*SE*
Task Efficacy								
complete exercise using proper technique	.86	.04	1.00	.00	.84	.04	1.08	.09
follow directions to complete exercise	.86	.04	.83	.06	.88	.04	1.00	.00
perform all of the required movements	.92	.02	.99	.04	.79	.04	.96	.07
Coping Efficacy								
exercise when you feel discomfort	.86	.03	1.00	.00	.73	.05	.86	.06
exercise when you lack energy	.92	.02	1.04	.05	.88	.03	1.00	.00
exercise when you don't feel well	.82	.03	1.05	.06	.82	.03	1.06	.09
Scheduling Efficacy								
include exercise in your daily routine	.93	.02	1.00	.00	.88	.03	1.00	.00
consistently exercise 4 times per week	.93	.02	1.09	.04	.79	.04	1.06	.07
arrange schedule to include regular exercise	.92	.02	1.05	.05	.83	.04	.96	.06
Perceived Competence								
feel I am able to complete exercises	.81	.03	1.00	.00	.81	.03	1.02	.06
can do even most challenging exercises	.83	.03	1.22	.09	.77	.05	1.05	.13
confident in ability to perform exercises	.90	.02	1.13	.05	.89	.02	1.09	.06
capable of completing exercises	.85	.03	1.08	.07	.86	.03	1.00	.00
capable of doing even most challenging	.83	.03	1.22	.08	.84	.03	1.13	.06
feel good about way I am able to complete	.75	.03	.98	.07	.73	.05	.91	.09
Perceived Autonomy								
feel free to exercise my own way	.72	.05	1.00	.00	.84	.03	.94	.07
feel free to make my own ex. decisions	.81	.03	1.36	.12	.81	.04	.98	.08
feel like I am in charge of my exercise	.84	.04	1.30	.16	.83	.03	.95	.08
feel like I have a say in choosing exercise	.87	.03	1.25	.15	.88	.03	1.03	.05
feel free to choose which exercises	.86	.03	1.21	.15	.91	.02	1.00	.00
feel like I am the one who decides	.78	.04	1.20	.15	.86	.03	1.02	.05
Perceived Relatedness								
feel attached to ex companions who accept me	.77	.03	1.00	.00	.66	.05	.85	.07
share a common bond with people	.83	.03	1.01	.05	.82	.03	.99	.06
feel a sense of camaraderie with ex companions	.90	.02	1.05	.05	.76	.05	.96	.09
feel close to ex companions . . .difficult ex	.83	.03	.97	.06	.78	.04	.93	.08
feel connected to people who I ex with	.86	.03	.95	.06	.84	.03	1.00	.00
feel I get along well with other exercisers	.67	.05	.66	.07	.84	.04	.94	.06

Note. β = Standardized factor loading; B = Unstandardized factor loading; SE = Standard Errors.

Table 3.

Interfactor Correlations from CFA and Score Reliability estimates – Study 1

		1	2	3	4	5	6
1	Task Efficacy	.91					
2	Coping Efficacy	.83$^{CL;ZH}$*	.90				
3	Scheduling Efficacy	.76$^{CL;ZMH}$*	.82$^{CL;ZH}$*	.95			
4	Perceived competence	.36$^{CM;ZL}$*	.42$^{CM;ZM}$*	.33$^{CM;ZL}$*	.86		
5	Perceived autonomy	.11	.07	.01	.32$^{CM;ZL}$*	.92	
6	Perceived relatedness	.10	.11	.11	.47$^{CM;ZM}$*	.14	.91

Note. *r* values should be interpreted as indicators of effect sizes and not in exclusive terms of their *p* values, due to their sensitivity to sample size (Zhu, 2012). Effect sizes according to Cohen (1992): ^{CM} Medium, ^{CL} Large; Effect sizes according to Zhu (2012): ^{ZM} Moderate, ^{ZMH} Moderately High, ^{ZH} High; * $p < .001$. Score reliability values (coefficient-α; Cronbach, 1951) are placed along the principal diagonal.

Table 4.

Interfactor Correlations from CFA and Score Reliability Estimates – Study 2

		1	2	3	4	5	6
1	Task Efficacy	.87					
2	Coping Efficacy	.64$^{CL;ZMH}$*	.84				
3	Scheduling Efficacy	.59$^{CL;ZM}$*	.79$^{CL;ZMH}$*	.86			
4	Perceived competence	.58$^{CL;ZM}$*	.62$^{CL;ZMH}$*	.55$^{CL;ZM}$*	.90		
5	Perceived autonomy	.32$^{CM;ZL}$*	.22	.28$^{CS;ZL}$*	.53$^{CL;ZM}$*	.94	
6	Perceived relatedness	.24	.35$^{CM;ZL}$*	.17	.46$^{CM;ZM}$*	.19	.92

Note. *r* values should be interpreted as indicators of effect sizes and not in exclusive terms of their *p* values, due to their sensitivity to sample size (Zhu, 2012). Effect sizes according to Cohen (1992): ^{CS}Small, ^{CM} Medium, ^{CL} Large; Effect size according to Zhu (2012): ^{ZL} Low, ^{ZM} Moderate, ^{ZMH} Moderately High, ^{ZH} High effect; * $p < .001$. Score reliability values (coefficient-α; Cronbach, 1951) are placed along the principal diagonal.

Figure 1. Final CFA Model for Study 1

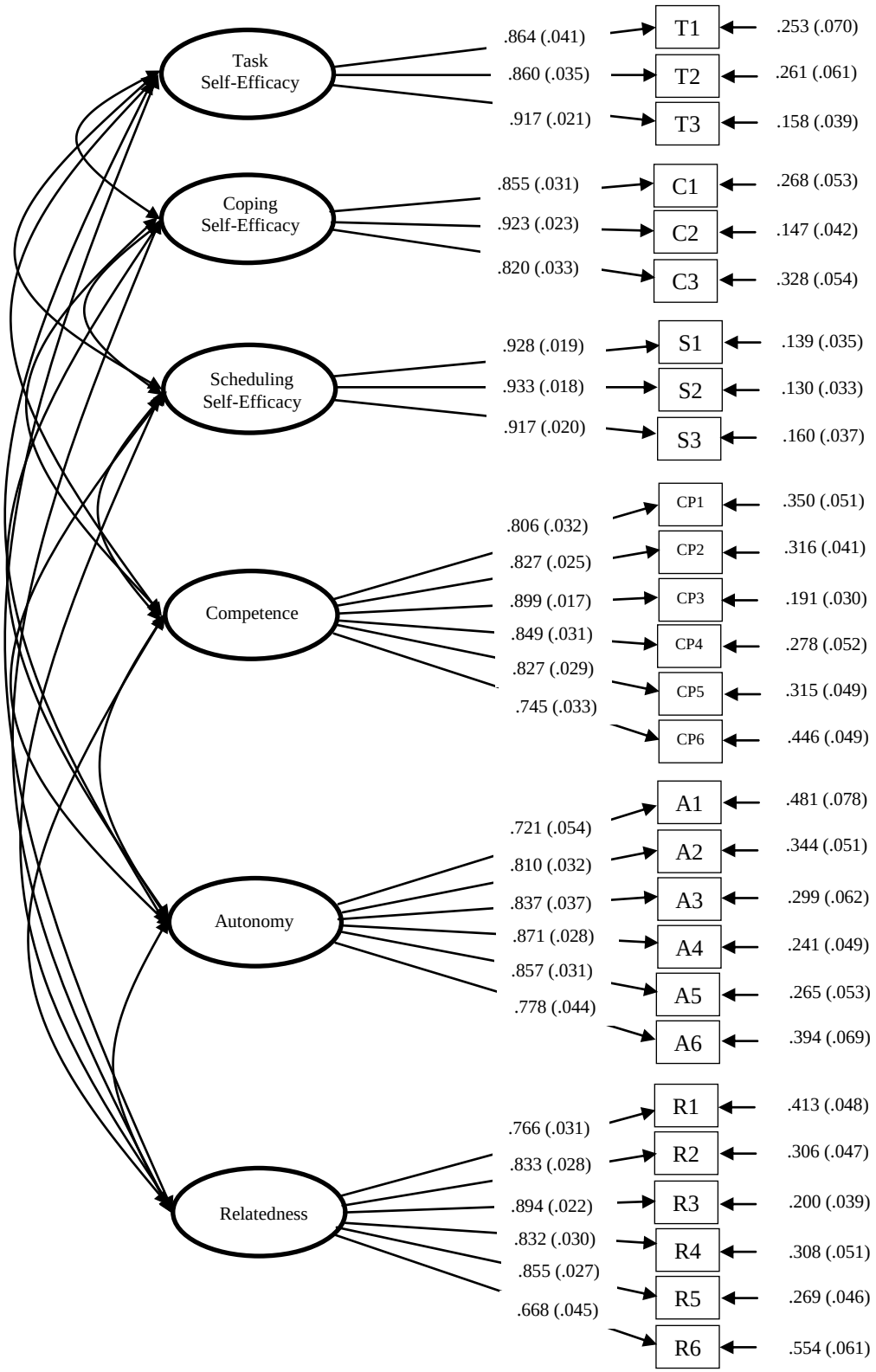

Figure 2. Final CFA Model for Study 2