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Self-Determination Theory and Exercise Behavior: An Examination of the Psychometric Properties of the Exercise Motivation Scale

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The purpose of these studies was to examine the psychometric properties of the Exercise Motivation Scale (EMS). One hundred forty-three undergraduates were surveyed in Study 1. Internal consistency reliability estimates ranged from .75 to .90 for the eight subscales. Discriminant validity was established via non-significant correlations with social desirability bias. The factor structure was confirmed by examining the intercorrelations of the EMS subscales which revealed a tenable simplex pattern. Differences on EMS subscales for participants at different Stages of Change supported group differentiation validity. Study 2 employed 58 undergraduates. Criterion validity was established by relationships between EMS subscales and distance walked during a self-selected intensity bout of exercise. A strong correlation between Exercise Identity Scale scores and integrated subscale scores supported the convergent validity of the integrated subscale. Overall the EMS yielded reliable scores and provided a valid means of making inferences about exercise behavior. Last, new findings about the relationship between the Self-Determination Theory and the Stages of Change Model are described which have significant applied implications.

Most Americans are sedentary despite the numerous well-known physical and psychological benefits accrued by engaging in exercise. This apparent motivation problem makes explaining and predicting components of exercise adherence especially important. Biddle and Nigg (2000) noted that while descriptive approaches for understanding exercise behavior are acceptable for starting research, substantial progress will only be made within a theoretical framework. One theory that is receiving attention in exercise and health psychology research is the Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2002).

Research based on SDT has lead to the postulation of several sub-theories: Basic Needs Theory, Cognitive Evaluation Theory, as well as Organismic Integration Theory (OIT). OIT identifies several distinct types of motivation (i.e., the "why" of actions). These types are presented as the self-determination continuum. Each distinct type of motivation has its own unique set of consequences in terms of performance and well-being. Each type also differs in terms of the degree to which the behavior has been internalized (taking in) and integrated (part of the self). Most are familiar with the difference between intrinsic and extrinsic motivation, however, OIT further differentiates extrinsic motivation into four subtypes. Each subtype of extrinsic motivation varies in terms of its degree of autonomy. This sets the stage for

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understanding the internalization process as well as allowing one to examine the degree to which a behavior is controlled versus self-determined.

It is important to note that type of motivation should not be confused with level of motivation; it is quite possible for someone's level of motivation to be high due to any of the types of motivation on the SDT continuum. In addition, it is important to emphasize that motivation is multifaceted and that an individual's overall level of motivation may be a result of elevated levels of multiple subtypes of motivation. The subtypes of motivation are explained below (Ryan & Deci, 2002).

Amotivation means "without motivation." A person does not act at all (apathetic/uninterested) or acts without intent. Individuals who are amotivated to exercise will most likely not engage in exercise. Possible reasons for their lack of engagement include the failure to see any value in exercising or repeated failure in previous attempts to exercise. In other words they see no contingency between attempts to exercise and achievement of desired outcomes. Amotivation is equated with an absence of self-determination.

Extrinsic motivation is subdivided into four types of regulation (external, introjected, indentified, and integrated). External regulation is most commonly associated with operant conditioning and is the least self-determined form of extrinsic motivation. Persons high in external regulation would engage in exercise to gain a desired consequence, such as approval from others. Introjected regulation is the next type of extrinsic motivation and represents motivation that is internalized but not part of the integrated self. Behaviors are engaged in to avoid shame and guilt or to experience pride. A person who is high in introjected regulation may exercise to avoid the guilt experienced as a consequence of not exercising. This form of regulation is not viewed as being self-determined as it is controlling and has not been assimilated to the self.

The third type of extrinsic motivation is identified regulation. Here the value of a given behavior in relation to one's own well-being is recognized and serves as the motive. Identified regulation is relatively, but not fully, self-determined as some goals may not be consistent with one's overarching values. In addition engaging a behavior to obtain a goal, such as improving one's health, makes the behavior instrumental rather than intrinsic. Integrated regulation is the fourth and most self-determined type of extrinsic motivation. Behaviors that have been brought into congruence with one's values, goals, and needs are viewed as being regulated via integration. A person high in integrated regulation would exercise because of the value they place on being healthy or because exercising is an important aspect of the individual's identity. Intrinsic motivation refers to engaging in activities out of interest, because the activity is challenging, novel, or inherently appealing (i.e., enjoyable). Intrinsic regulation is the most self-determined type of regulation. Those who are intrinsically motivated to exercise, exercise for the enjoyment experienced during the exercise bout. This is in opposition to extrinsically motivated behaviors engaged in for contingent outcomes that are separable from a behavior.

Research employing SDT has revealed that intrinsic motivation for exercising is positively related to exercise attendance (Oman & McAuley, 1993; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997). Previous research has also indicated that different subtypes of motivation along the SDT continuum are differentially related to exercise behavior (e.g., attendance, effort) as well as behavioral intentions to exercise. Two studies have reported that persons with more self-determined motivation exhibited higher exercise effort and better exercise performance as compared to persons with less self-determined motivation (Vansteenkiste, Simons, Soenens, & Lens, 2004; Wilson & Rodgers, 2004. Additional research revealed that more autonomous subtypes of regulation, such as identified and intrinsic regulation, account for significant amounts of variance in exercise behavior and cognitions, while less autonomous subtypes, such as external and introjected regulation do not (Wilson, Rodgers, Blanchard, & Gessell, 2003; Wilson, Rodgers, Fraser, & Murray, 2004).

Past research examining SDT in exercise contexts has employed measures adapted for the specific study or the Behavioural Regulation in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997). The original BREQ only assessed external, identified, introjected, and intrinsic regulations, omitting amotivation and integrated regulation. Recently items to assess amotivation regulations were added resulting in the BREQ-2 (Markland & Tobin, 2004). However, the BREQ-2 still omits integrated regulation, the most self-determined form of extrinsic motivation.

Li (1999) created the Exercise Motivation Scale (EMS) to assess all of the subtypes of regulation found on the SDT continuum. In addition, Li also incorporated Vallerand's (1997) tridimensional viewed of intrinsic motivation. Vallerand views intrinsic motivation as tridimensional with three different types of intrinsic motivation: intrinsic motivation to know, toward accomplishments, and to experience stimulation. Intrinsic motivation to know is where enjoyment is derived from learning, exploring, or trying to understand something new. Individuals who are intrinsically motivated towards accomplishment experience enjoyment from challenging themselves in an attempt to accomplish or create something. The focus is on one's effectiveness during the process, not the outcome. Intrinsic motivation to experience stimulation is where the individual engages in an activity because of the sensations experienced during the activity (e.g., the rush of adrenaline experienced while whitewater kayaking).

Li (1999) reported three studies describing the development and validation of the EMS. In study 1 items for the EMS were created in three phases. Phase 1 involved conceptual formulation, phase 2 consisted of a review of the literature on participant motivation for sport and exercise, and phase 3 consisted of interviews with college students about why they and their friends participated in exercise activities. Based on the three phases, items were created to reflect the motivation subtypes from the SDT continuum and general categories of reasons for exercise participation. An expert panel reviewed an initial pool of 33 items. Consequently, modifications were made including the deletion of one item.

The second study consisted of administering the 32-item measure to 371 college students. There were four items for each subtype of SDT (amotivation, external, introjected, identified, integrated, and the three types of intrinsic motivation). Examination of the confirmatory factor analysis (CFA) revealed that one of the amotivation items was loading negatively. After it was dropped, fit was improved to acceptable levels, TLI = .88, CFI = .89, and RMSEA = .06. Internal consistency estimates of reliability ranged from.75 to.90.

Study 3 consisted of administering the EMS to 571 college students. Participants also completed measures of perceived exercise competence, exercise autonomy, social relatedness, interest, and effort. Model fit statistics from CFAs were below acceptable levels for most indexes. However, Li argued that due to the process of internalization a simplex model analysis was more appropriate for examining the tenability of the EMS factor structure. Analysis of a simplex pattern involves examination of the interrelations among subscales that are expected to form an ordered pattern where the largest correlations are along a main diagonal and adjacent subscales along a continuum (e.g., SDT continuum) correlate more positively than those that are most distant from each other (Ryan & Connell, 1989). Li (1999) noted that the sequence of the relationships provided evidence of factorial validity. In addition, an examination of the fit of the simplex model revealed that the proposed simplex structure was tenable (TLI = .89, CF = .89, & RMSEA = .07). Li reported, "Tests on the selected antecedents and consequences of exercise motivation also showed evidence of nomological validity. . ." (p. 111) with a reasonable fit to the data. Li concluded that the EMS is "a theoretically sound and methodologically valid and reliable measure" (p. 112).

Li's studies provide initial evidence for the reliability and two forms of validity (factor structure and relationships with related constructs) for EMS; however, Messick (1989) noted

that validity is a matter of degree and not an all or nothing decision. In addition, Messick argued that construct validity is an ongoing process. It is also important to note that the participants for Li's (1999) studies were all college students enrolled in physical activity classes at a university in the Pacific Northwest region. In Study 1 and 2 the activity levels and gender break down of the students were not reported. In Study 3 there were 205 males and 393 females. The activity levels for students in Study 3 were: 38.7% did not exercise outside of their physical activity class, 12.5% exercised once per week, 12.7% twice a week, 23.1% three times a week, and 13% more than three times a week. It is important to note the participant characteristics of Li's studies to judge the equivalence of the sample employed in the current studies. The current studies employ a similar population but examine additional forms of validity beyond the two examined in Li's studies.

The purpose of this paper was to further examine the psychometric properties of the Exercise Motivation Scale (EMS, Li, 1999). The objectives of Study 1 were to assess the reliability, discriminant validity, factorial validity (simplex pattern among the subscales), and validity via differentiation among groups (Stages of Change model) for the EMS. The objectives of Study 2 were to assess the predictive and convergent validity of the EMS.

STUDY 1

The objectives of this study were fourfold. The first objective was to assess the internal consistency reliability via coefficient alpha estimates for each subscale. The second was to assess the discriminant validity using correlations among the EMS subscales and scores on a measure of social desirability bias. The third was to assess the factorial validity by examining the tenability of a simplex pattern among the subscales of the EMS. The fourth objective was to assess validity through differentiation among groups by employing the Stages of Change for engaging in regular exercise as the independent variable and using the subscales from the EMS as the dependent variables.

Stages of Change

The Stages of Change (i.e., Transtheoretical Model; Prochaska & DiClemente, 1983) refers to one's readiness for sustained participation in a given behavior and is a function of current engagement in that behavior. It takes into account an individual's current exercise status and the individual's intentions for future behavior. The model is often used to explain the exercise behavior change process with regard to the acquisition and maintenance of exercise behavior. Individuals are classified as being in one of five stages. Persons in the pre-contemplation stage do not exercise and are not thinking about starting an exercise program in the foreseeable future (in the next six months). Those in the contemplation stage do not currently exercise, but they are thinking about starting an exercise program in near future (in the next six months). Persons in the preparation stage plan on exercising and already exercise some, but not regularly. Individuals in the action stage have started to exercise regularly (three exercise sessions per week for at least 30 min per session), but have been doing so for less than 6 months. Those who have been exercising regularly for 6 months or more are classified as being in the maintenance stage. The model is cyclical as opposed to linear; individuals can regress back to a previous stage at anytime.

Matching intervention strategies to the stage of exercise readiness (Transtheoretical Model) results in significantly successful behavioral changes (Kim, Hwang, & Yoo, 2004). Research has shown that when the intervention strategy is mismatched to the Stage of Change, adherence

to physical activity is significantly lower as compared to those receiving stage-matched intervention strategies (Blissmer & McAuley, 2002).

Wankel (1988) suggested that initial involvement in an exercise program is often motivated by health-related benefits, whereas continued involvement is more dependent upon enjoyment of the exercise activity. Several studies have shown that intrinsic reasons are the most important for maintenance of long-term exercise (Frederick & Ryan, 1993; Perrin, 1979; Wankel, 1985). Numerous researchers have indicated that initial reasons for exercising are likely to be extrinsic (Dishman, 1987; McAuley, Wraith, & Duncan, 1991). Therefore, one would expect that persons in the lower Stages of Change for exercise would have lower levels of intrinsic motivation and those in higher stages would have higher levels. Previous research that examined differences in Stages of Change for exercise motives verified these expectations. Mullan and Markland (1997) found that scores for subscales of self-regulation were related to stage, such that more self-determined self-regulation scores were higher in higher stages.

Ingledew, Markland, and Medley (1998) found that the best motives for discriminating among the stages were a function they labeled enjoyment/revitalization (accounting for 63% of the variance). They equated this function with intrinsic motives. Centroid values of enjoyment/revitalization were highest for those in the maintenance stage and lowest for those in the precontemplation stage. Rose, Parfitt, and Williams (2005) examined the relationship between Stages of Change and exercise behavior regulation (i.e., SDT). They found that more self-determined forms of regulation (e.g., identified regulation) were related to higher Stages of Change for exercising.

The three studies above support the existence of differences in regulation for persons in different Stages of Change. Specifically, persons in the lower Stages of Change have lower levels of intrinsic motivation and those in higher stages have higher levels. However, it is important to point out the limitations of the three studies. First, all three studies were conducted in the United Kingdom, none have employed an American sample. Second, one study used categories of motives to infer regulation types (e.g., intrinsic or extrinsic), and the two that employed a measure of the regulation subtypes from the self-determination continuum only examined external, introjected, identified, and intrinsic regulation. The value of the current study is that it is the first to examine the full spectrum of regulation subtypes on the self-determination continuum with regard to the Stages of Change model.

Method

Participants

Undergraduate students at a regional university in the South of the USA were solicited as volunteers; 143 students volunteered (104 females, 37 males, 2 not reported). Their mean age was 21.27 ($SD = 4.44$), however the skewness was 2.62, therefore the median age of 20 years is a better indicator of central tendency. The range of participant ages was 17–46 years. See Table 1 for a breakdown of participants' activity levels via their Stage of Change placement. Participants completed the surveys for extra credit. Undergraduate students were targeted in an attempt to obtain an equivalent sample, as compared to Li's research samples.

Measures

The following variables were assessed: gender, age, stage of the transtheoretical model for exercising regularly, exercise motivation (EMS), and social desirability.

The Stages of Change measure developed by Marcus, Selby, Niaura, and Rossi (1992) was employed in this study. Development of this measure was based upon a similar measure for smoking cessation (Prochaska & DiClemente, 1983). The measure consists of five statements

Table 1
Means and Standard Deviations for Motivation Subscale Scores Across Stages of Change from Study 1

N = 143	Stage of change				
Subscale of motivation	**Precontemplation (*n* = 8)**	**Contemplation (*n* = 42)**	**Preparation (*n* = 50)**	**Action (*n* = 17)**	**Maintenance (*n* = 26)**
Amotivation	8.88 (4.02)	6.43 (3.25)	5.28 (2.75)	4.76 (2.95)	4.08 (2.00)
External	8.00 (3.55)	8.71 (3.97)	9.82 (4.40)	9.35 (4.96)	7.73 (3.39)
Introjected	8.88 (2.95)	12.36 (4.39)	13.40 (4.74)	15.12 (4.68)	15.73 (4.91)
Identified	13.38 (5.76)	19.43 (2.78)	20.26 (2.43)	21.12 (2.60)	22.46 (1.73)
Integrated	10.50 (4.28)	14.55 (4.26)	16.52 (3.79)	17.94 (3.25)	19.92 (2.95)
IM-Learn	9.50 (4.04)	13.31 (4.99)	14.18 (4.11)	15.88 (4.78)	17.31 (5.29)
IM-Accomplish	10.38 (4.84)	15.33 (4.19)	17.00 (3.45)	18.00 (3.89)	19.00 (3.09)
IM-Sensations	10.88 (5.08)	16.55 (4.06)	17.74 (3.15)	19.35 (3.22)	20.23 (3.31)

Note. The possible range for all exercise motivation scale (EMS) subcales except Amotivation is 4-24; the possible range for Amotivation is 3–18.

from which the participants choose the statement which best describes them. Each statement corresponds with one of the five stages. The test-retest reliability for the measure was .78. Concurrent validity of the measure has been demonstrated by Marcus and Simkin (1993). They compared results on the Stages of Change measure with the Seven Day Physical Activity Recall Questionnaire (Blair, 1984). Results revealed that scores on the recall instrument significantly differentiated among the Stages of Change, demonstrating concurrent validity.

The Exercise Motivation Scale was created to fill a void in the measurement of the multifaceted Self-Determination continuum (Li, 1999). The EMS consists of 31 items designed to assess the degree of self-regulation attributable to each of eight subscales from the Self-Determination continuum: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, intrinsic regulation to learn, intrinsic regulation to accomplish task, and intrinsic regulation to experience sensations. A 6-point Likert-type response format is used ranging from *Does not correspond at all* to *Corresponds exactly*. There are four items for every subscale except for amotivation which only has three items. Therefore amotivation scores may range from 3–18 and all other subscales scores may range from 4–24. Scores were summed across items for each subscale.

Li (1999) noted that estimates of coefficient alpha internal consistency reliability were near or at acceptable levels (i.e., $\sim$ .80; see Urbina, 2004) for the eight subscales. Note that Urbina (2004) suggested that scores with reliability estimates below .70 may not be very trustworthy. She also noted that while there is no minimum threshold for all purposes, most test users look for coefficients of .80 or higher. In addition, Nunnally and Berstein (1994) labeled a reliability coefficient of .70 as modest and noted that efforts to increase reliability much beyond .80 were often a waste of time and money. This discussion was within the context of research on groups and not decision-making about individuals.

The most often used measure employed to assess social desirability bias is the Marlowe-Crowne Social Desirability Scale (MC SDS; Crowne & Marlowe, 1960). Reynolds (1982) created three short forms of the MC SDS and examined their psychometric properties along with the psychometric properties of other short forms of social desirability bias. He concluded that the 13-item short form of the MC SDS he developed was superior to the other short forms examined based on reliability, convergent validity, and length (i.e., number of items).

Reynolds reported that the correlation between the 13-item short form and the full MC SDS was .93. Reliability estimates for the 13-item short form and the full MC SDS were similar; coefficient alpha for the 13-item short form was .76, not much lower than the estimate for the full version,.82. The response format for the 13 items is *True-False*.

Procedure

The researchers were allowed to solicit participants from introductory psychology classes during class. First students were given a general description of the questionnaires. Next, questionnaires were distributed and students who wished to participate were instructed to read and sign the informed consent. Students who chose to participate completed the questionnaires and returned them to the researcher.

Results

The internal consistency reliability of each subscale was assessed via coefficient alpha estimates. Coefficient alpha estimates for internal consistency reliability were at or above acceptable levels for five of the eight subscales (see the diagonals in Table 2). The three exceptions were external (.79) and identified (.79) regulation, both of which narrowly missed the acceptable level of .80 (Urbina, 2004), and introjected (.75). It is important to note that while the three subscales did not quite reach the acceptable level of .80, they did not fall below what Urbina considered an untrustworthy level of .70. Item analyses were examined for the three subcales which did not reach the .80 level. The external regulation subscale did have one item that lowered coefficient alpha from .82 to .79, Item 3, "because other people believe that it's a good idea for me to exercise." None of the items for the other two subscales lowered the coefficient alpha estimate.

Discriminant validity is established when low correlations are observed between measures of unrelated constructs using the same measurement method. The discriminant validity of the EMS subscales was examined in this study via correlations between the subscales and scores on a measure of social desirability bias. There was a lack of significant correlations between scores for seven of the eight subscales of self-regulation and scores for social desirability bias (see Table 2); introjected regulation was the lone exception; $r = -.20$, $p = .02$. However, a correlation of $-.20$ is substantially lower than the reliability estimates for the EMS subscales or

Table 2
Self-regulation Subscale Reliabilities, Intercorrelations, and Correlations with MC-SDS short form from Study 1

N = 143	1	2	3	4	5	6	7	8
1. Amotivation	.82							
2. External	.37**	.79						
3. Introjected	−.05	.44**	.75					
4. Identified	−.45**	−.07	.44**	.79				
5. Integrated	−.35**	.04	.59**	.69**	.84			
6. IM-Learn	−.24**	.05	.39**	.44**	.61**	.90		
7. IM-Accomplish	−.27**	.02	.51**	.62**	.79**	.75**	.80	
8. IM-Sensations	−.36**	−.04	.38**	.61**	.69**	.73**	.80**	.85
Social Desirability	−.10	−.09	−.20*	−.06	−.00	−.01	−.05	.07

Note. *, $p < .05$; **, $p < .01$. Coefficient alpha estimates of internal consistency for the exercise motivation scale (EMS) subscales appear on the main diagonal.

convergent validity coefficients suggested as markers for comparison in discriminant validity studies (Crocker & Algina, 1986).

The factorial validity of the EMS was examined by evaluating the tenability of a simplex pattern among the subscales of the EMS. Analysis of a simplex pattern involves examination of the interrelations among subscales that are expected to form an ordered pattern where the largest correlations are along a main diagonal and adjacent subscales along a continuum (e.g., SDT continuum) correlate more positively than those that are most distant from each other (Ryan & Connell, 1989). An examination of simplex pattern via intercorrelations among the subscales revealed that the largest correlations were on the diagonal, with a few exceptions. The few exceptions were the correlations among the three subscales of intrinsic motivation (IM). When one considers the reliability estimates and corrects for attenuation due to measurement error the correlations are: learn and accomplish, $r = .88$; learn and experience sensations, $r = .83$; accomplish and experience sensations, $r = .97$. It is doubtful that these subscales are tapping into different constructs, especially the accomplish and experience sensations subscales.

Examination of all of the intercorrelations revealed expected patterns. Amotivation was positively correlated with only one other type of self-regulation, external (see Table 2). This makes sense, as external regulation is the entryway into extrinsic motivation. Amotivation was negatively correlated with every other subscale except for introjected. External regulation was correlated with the subscales to its left and right on the SDT continuum, but no others. Introjected was most correlated with integrated and IM to accomplish. This raises questions about the introjected items. Perhaps the introjected items are measuring the need to boost the ego much more so than the need to avoid guilt and internal pressures. Identified correlated most with integrated and IM to accomplish. This seems reasonable as integrated is the next subscale on the continuum and persons probably strive to accomplish goals that are more personally valued. Integrated correlated most with IM to accomplish. One would expect participants to relate their self-concepts to their accomplishments. All of the IM subscales were highly correlated (.73, .75, and .80). These correlations support the simplex structure of the SDT continuum. However, the correlations among the three IM subscales also imply that perhaps these three subscales are converging on the same construct and that three separate subscales are not necessary.

The fourth objective of this study was to assess validity via differentiation among groups by employing the Stages of Change for engaging in regular exercise as the independent variable and using the subscales from the EMS as the dependent variables. A one-way multivariate analysis of variance (MANOVA) using the Statistical Package for Social Sciences (SPSS) default of type III sums of squares was used to determine whether individuals across the five Stages of Change differed with regard to their scores on the EMS. Means and standard deviations for each subscale of self-regulation across Stages of Change are reported in Table 1. MANOVA revealed significant differences among participants in different Stages of Change for the different motivation subscales along the self-determination continuum, Wilks' $\Lambda = .483$, $F(32, 484.70) = 3.31$, $p < .001$, multivariate $\eta^2 = .17$. Although the n's for some stages from the Stages of Change model were low, the observed multivariate power for the MANOVA was 1.00. Follow-up analysis of variance (ANOVAs) (see Table 3) revealed significant differences among the Stages of Change for all subscales of self-regulation except external. Amotivation scores were highest for those in the precontemplation stage and grew progressively lower in the higher stages. External regulation scores were highest for those in the preparation stage, followed by action, and contemplation. All other types of motivation evidenced the same pattern: the scores were lowest for those in the precontemplation stage and grew progressively

Table 3
Analysis of Variance (ANOVA) for Each Subscale of Self-Regulation with Stage of Change as the Independent Variable from Study 1

N = 143	*df*	*F*-value	*p*-value	η^2
Amotivation	(4, 138)	5.71	$p < .001$	.14
External	(4, 138)	1.30	$p = .274$	N/A
Introjected	(4, 138)	4.75	$p = .001$	.12
Identified	(4, 138)	18.42	$p < .001$	.35
Integrated	(4, 138)	13.85	$p < .001$	.29
IM-Learn	(4, 138)	5.71	$p < .001$	.14
IM-Accomplish	(4, 138)	10.06	$p < .001$	.23
IM-Sensations	(4, 138)	12.42	$p < .001$	.27

Note. Cohen (1988) defines η^2 as the proportion of the total superpopulation variance made up by the variance of the population means or the difference population membership makes with regards to the overall variability.

higher as one examined subscale scores for those in higher stages. Statistical power was at or above .95 for all EMS subscales except external regulation (power = .40).

STUDY 2

The purpose of this study was to examine the criterion (predictive) and convergent validity of the EMS. The correlations between scores for the different subscales of regulation on the EMS and distance walked on a manual treadmill at a self-selected pace for 15 minutes were examined (i.e., would EMS scores predict self-selected exercise intensity) to assess criterion validity. Second, because the integrated subscale is what makes the EMS unique, the convergent validity of the subscale was examined via the correlation between scores on the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994) and the integrated regulation subscale of the EMS. The EIS is a measure of exercise role identity salience.

Exercise Role Identity

Baron and Byrne (1991) use the terms self-identity and self-concept interchangeably, noting that an individual's self-concept strongly influences processing of social information, motivation, and affective stated. Callero (1985) states that an individual's self-concept is composed of numerous role-identities. Thus, a specific role-identity would be defined as one dimension of an individual's self-concept. These role-identities are formed based on an individual's behavior and the individual's perceived feedback from society about the behavior—not necessarily in that order.

The salience of an individual's role-identity carries with it several consequences. The higher the salience for a given role-identity the more likely the individual is to define herself by this role-identity. Thus, if someone has a high salience for the role-identity of being an exerciser then she would be expected to frequently describe herself to others as an exerciser. Calero (1985) proclaimed that the most visible consequence of role-identity salience is one's behavior, that is, what does it mean to be an exerciser? The answer is that the individual engages in exercise. As a result, the more salient the role identity the more frequent the individual will engage in behaviors that validate it. According to Calero, the variance for the salience of a particular role-identity is directly related to the variance in typical behaviors associated with that particular role identity. Salience of role-identity also affects how one is recognized by

others. In other words, an individual will be better known for more salient role identities. This is related to the other properties associated with salience. The higher the role-identity salience the more often the individual will 1) engage in typical role behaviors, 2) associate with others who share the same role-identity, 3) evaluate self-worth based on one's engagement in typical role behaviors, and 4) define oneself using that particular role identity.

Identified regulation occurs when behavior is engaged in because it is personally valued with regards to one's personal goals. Integrated regulation occurs when behaviors have been brought into congruence with one's values, goals, and needs. Therefore one would expect that role-identity salience would be significantly related to both identified and integrated regulation but share the most variance with integrated, because the behavior has been integrated into one's sense of self. One might also expect role-identity salience to be significantly correlated with intrinsic forms of motivation; individuals are more likely to habitually engage in behaviors that are inherently reinforcing. Examining the relationship between scores on a measure of exercise role-identity salience and scores on the integrated regulation subscale would allow one to assess the convergent validity of the integrated regulation subscale.

Method

Participants

Fifty-eight undergraduates enrolled in psychology courses served as participants (48 females and 10 males). Their mean age was 21.95 years ($SD = 6.17$), because the skewness was 2.47, the median age of 20 years is a better indicator of central tendency. The range of ages was 18–45 years. As an indicator of activity status Stage of Change was also assessed, resulting in the following distribution: contemplation (12), preparation (30), action (6), maintenance (10).

Measures

The Exercise Motivation Scale was used to assess the Self-Determination continuum (Li, 1999; see Study 1 for a description of the measure). The Exercise Identity Scale (EIS) developed by Anderson and Cychosz (1994) was used to measure the salience of exercise role-identity. The EIS consists of nine items with Likert-type responses ranging from 1 *strongly disagree* to 7 *strongly agree*, thus the range of scores is from 9 to 63. Scores on the EIS have been shown to demonstrate adequate reliability. Anderson and Cychosz (1994) reported a coefficient alpha of .94 and a test-retest reliability of .93 over a period of one week. In the present study a coefficient alpha estimate of .92 was found. In terms of validity, Anderson and Cychosz (1994) reported a correlation of .68 between scores on the EIS and the number of weeks persons reported having engaged in exercise. Anderson, Cychosz, and Frank (1998) reported significant positive relationships between scores on the EIS and the number of weeks participants reported exercising, frequency of exercise per week, and exercise intensity. Examination of the previous studies would lead one to conclude that the EIS appears to be a valid instrument for making inferences about exercise behavior. It definitely supports part of its theoretical definition in terms of the relationship between salience of the exercise role identity and exercise behavior.

Procedure

Participants registered for individual testing slots on a study board. Upon entering the lab each participant completed an informed consent form, EMS, and EIS. Next, participants were asked to walk for 15 min on a manual treadmill. Participants were instructed to walk as fast as they wanted. The only restriction was that the participant was to keep moving for the entire

15 min. The display of the treadmill was covered thus no feedback about distance or pace was visible to the participant.

Results

Descriptive statistics and internal consistency reliability estimates for each scale are reported in Table 4. Note that the reliability for the amotivation subscale falls below .70; this subscale is also the only subscale that has three items as opposed to four. All other subscale estimates were above untrustworthy level of .70, yet only three were at or above the desired level of .80.

The correlations between scores for the different subscales of regulation on the EMS and distance walked on a manual treadmill at a self-selected pace for 15 minutes were examined to assess criterion (predictive) validity. Although the EMS was created as a contextual measure, it should be able to predict situational behavior (top down); one would not expect the EMS to predict motivation for non-exercise behaviors (i.e., global or bottom up). The correlations between distance walked and the eight types of motivation were as follows: Amotivation, $r = -.31$, $p = .02$; External regulation, $r = -.25$, $p = .07$; Introjected regulation, $r = -.05$, $p = .74$; Identified regulation, $r = .12$, $p = .41$; Integrated regulation, $r = .21$, $p = .13$; Intrinsic motivation to accomplish, $r = .18$, $p = .21$; Intrinsic motivation to learn, $r = .24$, $p = .08$; and Intrinsic motivation to experience sensations, $r = .31$, $p = .02$ (Average of IM's = .24).

Two correlations between distance covered and the eight subscales of regulation were significant: amotivation and IM to experience sensations. Persons with higher amotivation scores covered shorter distances (lower intensity) and persons with lower amotivation scores completed greater distances. Persons with higher IM to experience sensation scores covered greater distances (higher intensity) and persons with lower IM to experience sensation scores covered shorter distances. The isolation of one form of IM as a significant predictor of self-selected intensity supports Li's (1999) decision of following Vallerand's (1997) tridimensional view of IM, at least at the situational level.

Although the magnitude of the remaining correlations is weak, the pattern is informative and supportive of the SDT continuum. There were progressively smaller negative correlations between distance walked and scores on motivation types where exercise is amotivated or regulated by external forces and progressively larger positive correlations between motivation types where exercise is more self-determined.

Table 4
Descriptive Statistics and Internal Consistency Reliability Estimates for SDT subscales and Exercise Role Identify Salience from Study 2 (N = 58)

Variable	Mean	Standard Deviation	Coefficient Alpha
Amotivation	4.22	1.63	.68
External reg.	7.84	3.57	.80
Introjected	12.64	4.31	.72
Identified	20.17	2.74	.74
Integrated	16.74	3.87	.78
IM-Learn	14.71	4.53	.92
IM-Accomplish	17.12	3.54	.73
IM-Sensations	18.00	4.03	.87
Role-Identity	34.16	12.79	.92

Because the integrated subscale is what makes the EMS unique, the convergent validity of that subscale was examined by examining the correlation between scores on the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994) and the integrated regulation subscale of the EMS. An examination of the correlations among salience of the exercise role identity and the eight subscales of self-regulation revealed, as predicted, that the integrated regulation subscale yielded the largest correlation, $r = .67$, $p < .001$. When corrected for attenuation due to measurement error the correlation increases to .79. These correlations support the convergent validity of the integration subscale. The remaining correlations were: Amotivation, $r = -.11$, $p = .41$; External regulation, $r = .01$, $p = .94$; Introjected regulation, $r = .04$, $p = .77$; Identified regulation, $r = .46$, $p < .001$; Intrinsic motivation to accomplish, $r = .57$, $p < .01$; Intrinsic motivation to learn, $r = .46$, $p < .01$; and Intrinsic motivation to experience sensations, $r = .61$, $p < .01$ (Average of IM's = .55).

DISCUSSION

The purpose of this paper was to further examine the psychometric properties of the Exercise Motivation Scale (EMS, Li, 1999). This was accomplished via two separate studies. The objectives of Study 1 were to assess the reliability, discriminant validity, factorial validity (simplex pattern among the subscales), and validity via differentiation among groups (Stages of Change model) for the EMS. The objectives of Study 2 were to assess the predictive and convergent validity of the EMS.

The coefficient alpha estimates of internal consistency reliability were at or near the acceptable level of .80 except for introjected regulation. Li (1999) reported the range and average coefficient alpha values for the EMS in two of his three reported studies: .75 to .90 with an average of .80 in Study 2 and .71 to .85 with an average of .77 in Study 3. In the current study the range was .75 to .90 and the average was.82. It is important to note that the test-retest reliability of the EMS has yet to be examined and should be a priority for future research.

Discriminant validity was examined via correlations among EMS subscales and scores on a short form of the MC SDS. The absence of a significant correlation would provide evidence of discriminant validity. This held true for seven of the eight subscales of the EMS. However, the introjected regulation subscales were significantly correlated with social desirability bias scores, $r = -.20$, $p = .02$. Even though the correlation is small in magnitude, it does raise questions about the validity of this subscale. It is important to further examine the social desirability bias of this subscale in future research and to compare the relationship between social desirability bias for scores on introjected regulation from the EMS as well as from scores on similar measures such as the BREQ. Scores on the BREQ have yet to be examined with regard to social desirability bias.

The factorial validity of the EMS was examined by evaluating the tenability of a simplex pattern among the subscales of the EMS. An examination of simplex pattern via intercorrelations among the subscales revealed that the largest correlations were on the diagonal with a few exceptions. These values were consistent with what Li (1999) had reported in almost all cases. The few exceptions with regard to the simplex pattern were the correlations among the three subscales of IM. An examination of Li's reported intercorrelations also reveal higher correlations among the three IM subscales. The high correlations among the IM subscales raise the question as to whether there really are separate subscales of IM. The one puzzling aspect was the intercorrelations of introjected regulation. Introjected regulation scores were most correlated with integrated and IM to accomplish. These are not the adjoining regulations on the SDT continuum. This raises questions about the introjected items. Perhaps they are

tapping into boosting of the ego too much and not as much into guilt and internal pressures. As stated earlier this was also the only subscale that correlated significantly with the social desirability scale. Future research should carefully examine this subscale.

Construct validity via group differentiation was established by examining differences across Stages of Change for EMS subscales. Amotivation scores were highest for those in the precontemplation stage. This was expected, as those in the precontemplation stage tend to focus on the negative aspects of exercising and fail to recognize the benefits (Prochaska, et al., 1994). Amotivation scores grew progressively lower as one progressed to higher stages. External regulation scores were highest for those in the preparation stage, followed by action, and contemplation. Mullan and Markland (1997) reported that in their study males in the preparation stage exhibited the highest external regulation scores. Mullan and Markland also examined introjected, identified, and intrinsic regulation scores across the Stages of Change reporting a linear pattern for all three of the subscales: lower scores for lower stages and higher scores for higher stages. In the current study all other subscales of the EMS (i.e., introjected, identified, integrated, and intrinsic) evidenced this same pattern: the scores were lowest for those in the precontemplation stage and grew progressively higher as one progressed to higher stages.

The Stages of Change Model (i.e., Transtheoretical Model; Prochaska & DiClemente, 1983) is one of the most often used theoretical models when doing applied work with individuals, groups, and communities (Marcus & Forsyth, 2003). Research has shown that when the intervention strategy is mismatched to the Stage of Change, then adherence to physical activity is significantly lower as compared to those receiving stage-matched intervention strategies (Blissmer & McAuley, 2002). The current study suggests that there is a distinct relationship between the Stages of Change Model and specific subtypes of regulation from SDT.

Persons in the pre-contemplation stage had the highest amotivation scores. Practitioners should be mindful that persons in the pre-contemplation stage may feel helpless due to past failures with regards to attempting an exercise program. Persons in the preparation stage had the highest external regulation scores, implying that they were more motivated by external incentives. Persons in the maintenance stage possessed the highest scores for all other subscales. The implications are that motivation for persons in the maintenance stage is multi-dimensional, tapping into guilt or pride, goals, personal identity, and intrinsic motives, thus practitioners should ascertain and encourage multiple types of motivation.

It is important to note that the highest subscale scores across all stages was the identified subscale. The observation of higher subscale scores across all stages for the identified subscale implies that people see exercise as highly related to some personally selected goal they have set or are contemplating setting. Although the literature on the Stages of Change Model emphasizes the importance of goals at the preparation stage, the current study suggests that goals should be utilized in all stages. Because the connection between the Stages of Change model and the SDT was only addressed at a cross-sectional level in the current study, future research should employ the EMS longitudinally to determine which subscales of the EMS are critical for each unique transition between Stages of Change (e.g., from action to maintenance).

Criterion validity was examined via correlations between distance covered during a self-regulated 15 min walk and scores on the eight subscales of regulation from the EMS. Li's (1999) validation research only included an examination of self-reports of exercise behavior and scores on the EMS, thus this is the first research to examine the relationship between actual exercise behavior and scores on the EMS. Examination of the correlations revealed a moderate but clear pattern that was supportive of the SDT continuum. There was a significant negative correlation between amotivation scores and distance covered ($-.31$). The correlations move in

a more positive direction as you move along the SDT continuum: −.25, −.05, .12, .12, and .24 (average IM). These results are similar to those reported by Vansteenkiste, et al. (2004). Their study examined the relationships between BREQ scores and free choice persistence for taiboo. They found similar patterns of correlations (i.e., negative correlations between persistence and less self-determined regulation and positive correlations between persistence and more self-determined regulation). It is important to note that the EMS was created as a contextual measure; a measure specifically designed to assess the SDT continuum at the situational level would have probably been a better predictor of situational behavior. The generalizability of the critierion validity findings in the current study is limited to individuals who are at least contemplating starting an exercise program. No volunteers were in the precontemplation stage for the current study.

From an applied perspective, the ability to predict the intensity that an individual will choose to exercise at would be valuable information. Therefore, for exploratory purposes, a regression analysis was conducted to examine the ability of the EMS to predict self-selected intensity (i.e., distance). A simple regression using the "enter" method on SPSS was run with distance as the dependent variable and the subscales of the EMS as the independent variables. The analysis revealed that the regression model was significant and accounted for 28% of the variance in self-selected intensity. Because one Stage of Change, preparation, had an *n* of 30 an additional regression analysis was run employing just participants in the preparation stage. This analysis also yielded a significant model and accounted for 63% of the variance in self-selected intensity. The applied implications are that stage-specific prediction models employing the EMS may yield important information for practitioners about their client's potential exercise behavior. Future research should be conducted to examine the ability of the EMS to predict various exercise behaviors across all stages.

Convergent validity for the integrated subscale was good. The correlation between salience of the exercise role identity and the integrated regulation scores was .67. When the correlation is corrected for attenuation it increases to .79 (Cronbach's alpha for integrated regulation was .78). This supports the convergent validity of the integration type scores.

Overall the results of this study suggest that the EMS yields reliable scores and seems to provide a valid means of making inferences about exercise behavior. The unique aspect of the EMS is its inclusion of the integrated regulation subscale, for which evidence of convergent validity was established in Study 2. There were several potential issues with the introjected regulation subscale, such as the weaker reliability estimates and significant correlation with social desirability bias. This subscale should be more closely examined in future research. Evidence emerged to both retain and abandon the tri-dimensional view of IM. The existence of high correlations among the three subscales would imply abandoning this approach. However, differences in relationships among the three IM subscales and self-selected intensities supports retaining the tri-dimensional approach. Future research to address this question is also warranted. Most importantly, the current study provided new information on the relationship between the SDT and the Stages of Change Model which has significant applied implications.

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