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Psychometric Properties of the Exercise Identity Scale in a University Sample

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Abstract

The purpose of this study was to examine the structural and criterion validity of scores derived form the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994). Participants (N = 269; 61.0% female) completed the EIS (Anderson & Cychosz, 1994), the Psychological Need Satisfaction in Exercise Scale (PNSE; Wilson, Rogers, Rodgers, & Wild, 2006), and the Godin Leisure Time Exercise Questionnaire (Godin & Shepherd, 1985). Confirmatory factor analyses indicated a 2-factor EIS measurement model comprised of role-identity and exercise beliefs factors provided a superior fit to the data compared with a unidimensional model. Correlational and multiple regression analyses suggested that both role-identity and exercise beliefs were associated with more frequent exercise behaviour and stronger psychological need fulfillment in exercise, although the pattern was more pronounced for role-identity. Collectively, these results suggest the EIS may hold some promise for advancing our understanding of exercise identity issues and highlights the need for further construct validation research with the EIS.

Keywords: construct validity, motivation, self-determination theory

The benefits of regular physical activity participation, in terms of reducing all cause mortality (Bouchard, Blair, & Haskell, 2007) and improving markers of mental health (Biddle, Fox, & Boutcher, 2002), are now well established. Nevertheless, fifty-one percent of the Canadian population remains insufficiently active to accrue the health benefits attributable to regular physical activity (Cameron, Craig, & Paolin, 2005) and attrition rates from structured exercise programs remain high across the early stages of behavioural initiation (Craig, Cameron, Russell, & Beaulieu, 2001). Considering the importance of physical activity to public health, it is hardly surprising that support for research examining the factors shaping the decision to initiate, sustain, or terminate physical activity involvement has been forthcoming (Bouchard et al., 2007; Bauman, Sallis, Dzewaltowski, & Owen, 2002; Biddle, Fox, & Boutcher, 2000). One approach that may hold some appeal in this regard is the notion of identity.

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Theoretical work, largely in the area of sociological social psychology, has provided a framework within which to understand identity as a pivotal factor for behavioural regulation within larger social structures (Cast & Burke, 2002; Stets & Burke, 2003; Stryker & Burke, 2000). Central to this line of theory development has been the interplay between social identity theory, stemming from Tajfel and Turner's (1979) work on intergroup discrimination, and identity theory (Burke & Reitzes, 1991; Stryker, 1980). Social identity theorists propose that identity is concerned with the degree to which an individual is enmeshed within (or discriminated from) a predefined social group or category (Stets & Burke, 2002) and minimizes the importance of intragroup role behaviour. Identity theory, in contrast, recognizes the importance of socio-structural influences on identity formation and behaviour, as well as accounts for the self's internal dynamics that impact behavioural decisions (Cast & Burke, 2002; Stets & Burke, 2003; Styker & Burke, 2000). The concept of identity (or identity formation), central to the framework of identity theory, represents a series of ongoing processes between an individual and the social environment that illustrate the values, roles, and beliefs adopted by individuals over time as they shift between contexts (Ryan & Deci, 2003; Stets & Burke, 2003).

Research from the perspective of identity theory has focused predominantly on the importance of roles as influential factors shaping behavioural variability during identity formation (Stets & Burke, 2003). Role-identity represents a social position that an individual devises through interactions with others in particular environments (McCall & Simmons, 1978; Stryker, 1980). Role-identities represent attractive concepts for understanding persistence behaviours given that a reciprocal relationship is posited to exist between role-identity and behavioural investment, whereby people will regulate their behaviour in a manner that is consistent with the roles they hold or adopt (Baumeister & Vohs, 2003; Stets & Burke, 2003). Exercisers, for example, who incorporate the role of being physically active into their identity would act in accordance with this role and engage in exercise-related activities to reinforce this aspect of their self-concept. Preliminary studies in the exercise domain have supported such a link given that the extent to which a person identifies with exercise as a portion of their self-concept is linked with greater frequency of exercise behaviour and predicts maintenance of future exercise participation (Anderson & Cychosz, 1994; Anderson, Cychosz, & Franke, 1998; 2001; Cardinal & Cardinal, 1997; Strachan, Woodgate, Brawley, & Tse, 2005).

An important avenue for advancing the study of identity in exercise contexts concerns the development of instruments capable of measuring this construct. One instrument developed for the purpose of measuring the extent to which a person views exercise as an integral part of their self-identity is the Exercise Identity Scale (EIS; Anderson & Cychosz, 1994). The development of the EIS was based largely on previous studies of role-identity to assess the degree to which exercise participation was descriptive of the person's self-concept (Anderson & Cychosz, 1994). Anderson and Cychosz (1994) provided structural validity evidence in their initial study of university students (n = 51) using exploratory factor analyses (principal components factor extraction) that supported a one-factor solution accounting for 67.6% of the total EIS item variance. Further criterion validity evidence was reported by using the number of weeks participants exercised to

predict exercise identity measured by a global EIS score (ß =.58, $p < .001$; Anderson & Cychosz, 1994).

Further research by Anderson and colleagues has provided additional construct validity evidence for EIS interpretations within community samples and corroborated the link between indices of exercise behaviour and stronger perceptions of an exercise identity (Anderson, Cychosz, & Franke, 1998; 2001). Relative age effects have also been noted with research using the EIS, whereby younger exercisers reported greater salience of exercise to their identity compared with non-exercisers of the same age or older exercisers (Anderson et al., 2001). One additional study by Cardinal and Cardinal (1997) reported increases in exercise identity over a 14-week period in female college students attending aerobic exercise classes and noted that future exercise participation correlated with exercise identity across the 14-weeks (*r*'s ranged from 0.34 to 0.48 respectively). Taken together, data supporting the internal consistency reliability of EIS responses (Cronbach α's ranged from 0.82 to 0.95; Anderson, Cychosz, & Franke, 2001; Cardinal & Cardinal, 1997), the available evidence suggests that the EIS holds promise as an index of exercise identity.

While the EIS appears useful for advancing our understanding of the exercise identity-behaviour relationship, it is surprising that few systematic attempts have been made to evaluate the construct validity of EIS scores. A careful examination of previous studies using the EIS reveals a number of limitations that warrant attention. First, the structural validity of the EIS has received little psychometric evaluation, and no attempt has been made to test the hypothesized unidimensional factor structure proposed by Anderson and Cychosz (1994) using confirmatory factor analysis. Careful inspection of the item content suggests that only a portion of the EIS items represent role-identity (e.g., "I consider myself an exerciser") while the remaining items represent beliefs about exercise in general (e.g., "I need to exercise to feel good about myself") or being an exerciser (e.g., "For me, being an exerciser means more than just exercising"). Clarity around the content domain represented within EIS items has not been tested extensively in previous studies and yet remains a pervasive issue in the measurement of psychological concepts closely aligned with identity (Marsh & Yeung, 1999). Second, Anderson et al. (2001) utilized stepwise regression techniques that have been questioned on the grounds that resultant models are rarely supported under cross-validation attempts (Thompson, 2001). Third, despite the importance of exercise identity to understanding behavioural investment in physical activity, little attempt has been made to situate the EIS within a broader nomological network (Cronbach & Meehl, 1955) of motivational influences shaping exercise participation. Ryan and Deci (2003) have argued from the perspective of Self-Determination Theory (SDT) that identity should be inextricably linked to the satisfaction of key psychological needs for competence, autonomy, and relatedness which form the basis for the self's assimilation with the social world. Ryan (1995) has extolled the importance of testing propositions put forth under the banner of SDT in applied domains (such as exercise) where contextual nuances may impact the generalizability of SDT-based claims. Given that Messick (1995) suggests that construct validation is an ongoing process of accumulating evidence to inform the interpretation of test scores and their use, it

seems that there is considerable scope for further investigation of the EIS to evaluate the merit of this instrument.

The purpose of this investigation was to examine psychometric properties of scores derived from the EIS. To address this purpose, data were collected to examine the EIS's structural validity, criterion validity in relation to frequency of exercise behaviour, internal consistency reliability (Coefficient α; Cronbach, 1951) and to probe relationships between exercise identity measured by the EIS and perceptions of psychological need satisfaction drawn from SDT (Ryan & Deci, 2003) to situate the EIS within a broader nomological network (Cronbach & Meehl, 1955). Perceptions of psychological need satisfaction and frequency of exercise behavior were drawn from both SDT (Ryan & Deci, 2003) and previous studies using the EIS (Anderson & Cychosz, 1994; Cardinal & Cardinal, 1997) to form the nomological network. Drawing on previous exercise identity research (Anderson & Cychosz, 1994) and arguments forwarded by Ryan and Deci (2003) within the framework of SDT, it was hypothesized that (a) a unidimensional measurement model would account for variation in EIS scores, (b) a stronger exercise identity would predict greater frequency of exercise behavior, and (c) a stronger exercise identity would be positively associated with fulfillment of competence, autonomy, and relatedness needs within exercise.

Method

Participants

A total of 269 students, drawn from undergraduate physical education and kinesiology classes at a medium-sized university in Central Canada, provided data for this study without receiving academic credit or remuneration. The sample consisted of 104 males (M_{age} = 20.77 years; *SD* = 1.75; Range = 19-29 years) and 164 females (M_{age} = 20.06; *SD* = 1.37; Range = 18-27 years). One participant did not provide gender. Information on participant ethnicity was not collected in this study. Participant's self-reported height and weight data were used to compute body mass index (BMI) values for men (M_{BMI} = 24.41 kg/m^2; *SD* = 2.59) and women (M_{BMI} = 22.73 kg/m^2; *SD* = 2.74). Based on Canadian guidelines (Health Canada, 2003), the sample was comprised of the following weight classifications: (a) Underweight (1.3 percent women; 1.0 percent men); (b) Normal Weight (81.0 percent women; 55.9 percent men); (c) Overweight (13.9 percent women; 40.2 percent men); and (d) Obese (2.5 percent women; 1.0 percent men). Self-reported exercise behaviour varied in this sample across 7 days preceding data collection ($M_{GLTEQ\text{-}METS}$ Males = 68.36; *SD* = 30.06; $M_{GLTEQ\text{-}METS}$ Females = 60.19; *SD* = 26.48) based on participant responses to the Godin Leisure Time Exercise Questionnaire (Godin & Shepherd, 1985). Based on the classification scheme proposed by Rodgers and Gauvin (1998), 81.6% of the males and 62.0% of the females in this sample likely represent "regular exercisers" given their participation in 3 or more strenuous exercise sessions per week.

Measures

Demographics. Participants provided self-reported data pertaining to their age, gender, height, and weight which were converted into kilograms and metres then transformed into BMI scores.

Exercise Identity Scale (EIS). Participants completed the 9-item EIS developed by Anderson and Cychosz (1994) to assess the salience of identifying with exercise as an integral portion of the self-concept. Participants responded to each EIS item on a scale, anchored at the extremes by (1) Strongly Disagree and (7) Strongly Agree, after reading a stem that contextualized each item within their personal exercise experiences (e.g.., "The following questions concern your personal beliefs about exercise. Please indicate the degree to which you agree or disagree with each statement when thinking about your exercise participation."). Previous research using the EIS has supported the internal consistency reliability (Cronbach's α's range from 0.82 to 0.95; Anderson, Cychosz, & Franke, 2001; Cardinal & Cardinal, 1997) and criterion validity of EIS scores by demonstrating positive correlations with indices of exercise participation (Anderson & Cychosz, 1994; Cardinal & Cardinal, 1997).

Psychological Need Satisfaction in Exercise Scale. Participants completed the 18-item PNSE (Wilson, Rogers, Rodgers, & Wild, 2006) that is designed to measure three factors representing the degree of competence, autonomy, and relatedness to fellow exercisers perceived in exercise contexts. A stem statement anchored each item in terms of how participants usually felt while exercising (e.g., "The following statements represent different feelings people have when they exercise. Please answer the following questions by considering how you typically feel while you are exercising."). Participants responded to each PNSE item on a scale anchored by 1 (False) and 6 (True). Sample items characterizing each PNSE subscale were as follows: (a) "I feel that I am able to complete exercises that are personally challenging" (PNSE-Perceived Competence; 6 items); (b) "I feel free to choose which exercises I participate in" (PNSE-Perceived Autonomy; 6 items); and (c) "I feel attached to my exercise companions because they accept me for who I am" (PNSE-Perceived Relatedness; 6 items). One previous study by Wilson et al. (2006) provided evidence of the structural validity of the scores derived from the 3-factor correlated PNSE measurement model ($\chi 2 = 688.03$; $df = 132$; $p < 0.01$; *CFI* = 0.94; *IFI* = 0.94; *SRMSR* = 0.07; *RMSEA* = 0.09 [90% *CI* = 0.08-0.09]) and convergent validity of PNSE scores (Pearson *r*'s between PNSE subscale scores ranged from 0.10 to 0.46; all *p*'s < .01). Internal consistency reliability values in physically active university students reported by Wilson et al. (2006) were as follows: (a) PNSE-Perceived Competence =0.91; (b) PNSE-Perceived Autonomy = 0.91; (c) PNSE-Perceived Relatedness = 0.90.

Exercise Behaviour. Participants completed a modified version of the Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shepherd, 1985). This instrument assesses the frequency of mild, moderate, and strenuous exercise completed for 15 minutes or more per session over a typical week. A global exercise score expressed in METS (a unit representing the metabolic equivalent of physical activity in multiples of resting oxygen

consumption) can be calculated using an equation proposed by Godin and Shepherd: ∑[(mild x 3) + (moderate x 5) + (strenuous x 9)]. Previous research suggests the GLTEQ is easy to administer and understand, responsive to changes in exercise behavior, and correlative to the expected direction with other physical activity and fitness indices (Jacobs, Ainsworth, Hartman, & Leon, 1993). Participant responses to each GLTEQ item were weighted by their corresponding MET value using Godin and Shepherd's formula and aggregated into an omnibus exercise behaviour score named GLTEQ-METS.

Procedures

Data were collected from intact groups using consistent instructions from the same research assistant to prevent the introduction of between-groups variation on the basis of test administration. Participants were provided with a letter of invitation upon entry into the classroom where data collection was scheduled and offered the opportunity to ask questions about the nature of the study or their involvement before providing written informed consent. The presentation of the items within each instrument comprising the questionnaire was randomized to reduce the likelihood of order effects in the sample data. All procedures were reviewed and cleared by a university-based Research Ethics Board prior to initiating this study.

Data Analyses

The data analyses were completed sequentially. First, the data were screened for missing values and outliers and examined for conformity with the assumptions of relevant statistical tests, including the selection of an estimator for the measurement model analyses. Second, a series of measurement models was specified and evaluated using confirmatory factor analysis (CFA) with AMOS 6.0 to asses the structural validity of EIS scores. A unidimensional measurement model was examined initially based on previous studies using the EIS (Anderson & Cychosz, 1994) followed by a revised 2-factor measurement model that was grounded in relevant identity theory (Cast & Burke, 2002; Stryker & Burke, 2000).[1] Conventional standards were specified for all CFA's, including freeing items to load exclusively on target latent factors, constraining uniqueness values to zero, fixing the loading of one manifest item to 1.0 to define the scale for the model, and freeing the paths between latent factors to correlate in the 2-factor measurement model. Third, SPSS 15.0 was used to calculate internal consistency reliability estimates (Coefficient α; Cronbach, 1951), descriptive statistics, and bivariate correlations. The final stage of the analysis involved computing hierarchical multiple regression models using SPSS 15.0 to determine the criterion validity of EIS scores for predicting exercise behaviour after controlling for age, gender, and BMI.

A number of indices were used to evaluate model fit (Hoyle & Panter, 1995; Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004). The χ^2 was reported but not given substantial interpretative credence given the sensitivity of this index to sample size and minor deviations between the implied model and observed data that have limited practical

utility (Hoyle & Panter, 1995). The comparative fit index (CFI), incremental fit index (IFI), and non-normed fit index (NNFI) were used primarily to interpret model fit along with the standardized root mean square residual (SRMSR) and root mean square error of approximation (RMSEA) and associated confidence interval based on conventional recommendations (Browne & Cudeck, 1993; West, Finch, & Curran, 1995; Hu & Bentler, 1999; Marsh, Hau & Wen, 2004). While some dispute exists pertaining to threshold values indicative of acceptable model fit in CFA applications (Hu & Bentler, 1999; Marsh et al, 2004), models that display CFI/IFI/NNFI values of 0.90 and 0.95 are typically considered indicative of acceptable and excellent fit (Hu & Bentler, 1999; Marsh et al., 2004). SRMSR values can range from zero to 1.0 with values less than 0.05 considered desirable (Ullman, 2007). RMSEA values of 0.05 and 0.08 typically denote excellent and reasonable fits respectively between the structural model and the data, while values exceeding 0.10 represent a poor fitting model (Browne & Cudeck, 1993).

Results

Preliminary Data Screening and Selection of an Estimator

An inspection of participant responses indicated that no more than 4.08 percent of scores on the GLTEQ items were missing and less than 1.12 percent of scores on the EIS or PNSE items were missing. No systematic pattern of non-response was evident in the data which were deemed missing at random and replaced using the sample mean (Hawthorne & Elliot, 2005). No extreme responses were noted in the sample data, and the univariate distributional properties of responses to each EIS item approximated normality (see Table 1). Notable multivariate kurtosis was evident in the sample data (Mardia's (1970) coefficient = 46.74); therefore, maximum likelihood estimation was used given that this estimator is less susceptible to distortion from non-normality in small samples (West et al., 1995). The histogram of standardized residuals approximated normality although age and GLTEQ-METS scores exhibited mild kurtosis, and visual inspection of the scatterplots implied linearity was tenable. Five cases were removed on the basis of displaying large standardized residuals (>4.0) during the regression model analysis.

CFA of the Exercise Identity Measurement Models

The unidimensional EIS measurement model differed from the target independence model (see Table 2), which is hardly surprising given the sensitivity of the χ^2 statistic to sample size. Closer inspection of the global model fit indices (see Table 2) suggests a mixed pattern of support for this measurement model. Both the CFI and IFI values exceeded conventional standards indicative of tenable model fit. However, the RMSEA point estimate and upper boundary of the 90% confidence interval surpassed tolerable limits. The matrix of standardized residuals suggested no overall concerns with reference to over- or under-estimation of fitted correlations (94.44% $z \leq 12.01$; 0% > 13.01), although EIS Item 9 clearly displayed the pattern of largest standardized residuals (62.5 % z's > 11.01) compared to other EIS items and the weakest standardized factor loading (see Table 1). The

Table 1. Distributional properties and standardized item loadings of manifest EIS items used in the CFA

					Model 1		Model 2			
							Factor 1		Factor 2	
Item No.	EIS items	M	SD	Range	FL	SE.	FL	SE	FL	SE
1.	I consider myself an exerciser	5.80	1.20	1-7	.79	.08	.83	.04	-	-
2.	When I describe myself to others, I usually include my involvement in exercise	5.24	1.55	1-7	.70	.10	.70	.09	-	-
3.	I have numerous goals related to exercising	5.59	1.29	2-7	.68	.08	-	-	.70	.07
4.	Physical exercise is a central factor to my self-concept.	5.46	1.35	2-7	.77	.08	-	-	.80	.10
5.	I need to exercise to feel good about myself	4.69	1.75	1-7	.53	.11	-	-	.59	.13
6.	Others see me as someone who exercises regularly	5.20	1.47	1-7	.85	.09	.91	.12	-	-
7.	For me, being an exerciser means more than just exercising	5.27	1.65	1-7	.64	.10	-	-	.68	.08
8.	I would feel a real loss if I were forced to give up exercising	5.69	1.57	1-7	.65	.10	-	-	.65	.12
9.	Exercising is something I think about often.	5.63	1.33	1-7	.46	.09	-	-	.50	.10

Note. EIS = Exercise Identity Scale. M = mean of EIS item scores. SD = standard deviation of EIS item scores. Range = range of EIS item scores in present sample. FL = standardized factor loadings from CFA. SE = standard errors from CFA. Model 1 = Original EIS unidimensional measurement model comprised of one latent factor with 9 manifest items. Model 2 = Alternative EIS measurement model comprised of two latent factors defined by three (Factor 1-Role Identity; EIS items 1, 2, and 6) and six (Factor 2-Exercise Beliefs; EIS items 3, 4, 5, 7, 8, and 9) manifest items respectively. All manifest items in both models loaded significantly on their target latent factor ($p < .05$).

modification index (Lagrange Multiplier) indicated that the largest improvement in model fit could be obtained by correlating the error terms associated with EIS items 1 and 6.

An alternative two-factor measurement model was specified following joint consideration of the unidimensional CFA results combined with relevant identity theory (Cast & Burke, 2002; Stryker & Burke, 2000). The two-factor model was comprised of items loading on factors representing role identity (EIS items 1, 2, and 6; see Table 1) and exercise beliefs (EIS items 3, 4, 5, 7, 8, and 9; see Table 1) that were strongly correlated ($\phi = 0.84$, $p < .01$). Global model fit indices (see Table 2) suggested a marked improvement in fit for the 2-factor model that was substantiated by a chi-square difference test between the measurement models ($\chi^2 = 53.37$, $df = 1$, $p < .01$). Notably, the CFI and IFI values exceeded Hu and Bentler's (1999) recommendations while the NNFI approached levels indicative of excellent model fit and the RMSEA and SRMSR values fell within tolerable limits. The pattern of standardized residuals (100% $z < |2.01|$), along with the stronger pattern of standardized factor loadings (see Table 1), combined with the more

Table 2. Global indices of model fit for original and alternative EIS measurement models

Measurement Models	χ^2	*df*	*p-value*	*CFI*	*IFI*	*NNFI*	*SRMSR*	*RMSEA (90% CI)*
Model 1, one-factor	122.90	27	<.01	0.91	0.91	0.88	.06	0.12 (0.10-0.14)
Model 2, two-factors	69.53	26	<.01	0.96	0.96	0.94	.04	0.08 (0.06-0.10)

Note: Model 1 = Original EIS unidimensional measurement model comprised of one latent factor with 9 manifest items. Model 2 = Alternative EIS measurement model comprised of two latent factors defined by three (Factor 1-Role Identity) and six (Factor 2-Exercise Beliefs) manifest items respectively. χ2 = chi-square test statistic. *df* = Degrees of Freedom. *CFI* = Comparative Fit Index. *IFI* = Incremental Fit Index; *NNFI* = Non-Normed Fit Index; *SRMSR* = Standardized Root Mean Square Residual; *RMSEA* = Root Mean Square Error of Approximation. 90% *CI* = 90 percent confidence interval around *RMSEA* point estimate.

desirable global model fit indices collectively suggest greater support for the 2-factor EIS measurement model in this sample. All subsequent analyses incorporated the 2-factor scoring configuration for the EIS into our a priori data analytical plan.

Descriptive Statistics and Reliability Estimates

Internal consistency reliability estimates (Cronbach's α; Cronbach, 1951) of observed scores (see Table 3) ranged from 0.81 to 0.92, suggesting the presence of minimal error variance in sample scores. Descriptive statistics presented in Table 3 indicate that participants reported greater fulfillment of competence and autonomy than relatedness needs in exercise settings and higher levels of weekly exercise participation than previous studies of university-students (Hayes, Crocker & Kowalski, 1999; Wilson, Rodgers, Fraser, & Murray, 2004). Participants further reported similar endorsement of both role-identity and exercise beliefs.

Nomological Relationships with Perceived Psychological Need Satisfaction and Exercise Behaviour

Inspection of the bivariate correlations (see Table 3) indicates, as hypothesized, that greater satisfaction of psychological needs in exercise is associated with stronger endorsement of both role-identity and exercise beliefs although the pattern is most pronounced for competence perceptions (see Table 3). Greater endorsements of role-identity and exercise beliefs were positively correlated with exercise frequency. Hierarchical multiple regression analysis controlling for the influence attributable to age, gender, and BMI was conducted to further examine the relationship between exercise identity and behaviour (see Table 4). Both the Variance Inflation Factor (1.01 to 1.32) and Tolerance (0.76 to 0.99) values suggested the presence of collinearity in the data; however, no two Variance Proportion Values were greater than or equal to 0.50 when the Condition Index exceeded ten (Pedhazur, 1997). Two noteworthy patterns emerged from the multiple regression analyses. First, EIS-Role Identity and EIS-Exercise Belief scores accounted for

Table 3. Descriptive statistics and bivariate correlations between EIS, PNSE, and exercise behaviour

Study Variables	M	SD	Skew.	Kurt.	α	1.	2.	3.	4.	5.	6.	7.	8.
1. Age	20.33	1.56	2.14	6.42	-	-							
2. BMI	23.38	2.80	0.61	0.56	-	.09	-						
3. EIS-Role Identity	5.41	1.23	-0.84	0.38	0.84	.01	.00	-					
4. EIS-Exercise Beliefs	5.39	1.08	-0.52	-0.53	0.81	.03	.09	.70	-				
5. PNSE-Competence	5.15	0.76	-1.17	1.74	0.91	.04	.03	.57	.45	-			
6. PNSE-Autonomy	5.51	0.70	-2.22	7.31	0.92	.06	-.10	.30	.16	.50	-		
7. PNSE-Relatedness	4.60	0.95	-1.07	1.44	0.89	-.08	-.04	.27	.33	.33	.15	-	
8. GLTEQ-METS	63.28	28.14	1.46	4.09	-	-.05	-.02	.41	.36	.32	.11	.29	-

Note. PNSE = Psychological Need Satisfaction in Exercise Scale (Wilson et al., 2006). GLTEQ-METS = Summary weekly exercise score from the Godin Leisure time Exercise Questionnaire (Godin & Shepherd, 1986). α = Cronbach's Coefficient α (Cronbach, 1951). Correlation matrix is based upon pairwise comparisons with equivalent sample sizes across each element in the matrix. All *r*'s > |.15| are significant at $p < .05$ (two-tailed).

18 percent of the variance in exercise behaviour beyond that attributable to demographics previously linked with regular physical activity (Bouchard et al., 2007). Second, visual inspection of the standardized regression coefficients, as well as the portion of unique variance accounted for by each predictor variable in the regression model, suggests that EIS-Role Identity appears to be the strongest predictor of the weekly frequency of exercise behaviour.

Discussion

The purpose of this investigation was to extend the construct validity evidence for the EIS by examining both structural and criterion validity issues in a sample of physically active exercisers and explore a plausible nomological network for exercise identity by incorporating the basic psychological needs proposed within SDT (Deci & Ryan, 2002) and exercise behaviour. The CFA results, combined with the internal consistency reliability estimates testing the EIS's structural validity, failed to support the unidimensional measurement model proposed by Anderson and Cychosz (1994) and offered stronger support for a revised 2-factor measurement model comprised of factors representing role-identity and exercise beliefs. The results of this investigation also make it apparent that greater endorsement of, and belief in, exercise as a salient component of one's identity is associated with more frequent exercise participation in university students and greater psychological need fulfillment in exercise settings that is consistent with SDT (Ryan & Deci, 2003). While the process of construct validation is ongoing (Messick, 1995), it seems reasonable to conclude on the basis of this investigation that the EIS holds promise for the examination of identity issues in exercise contexts.

Table 4. Regression analyses predicting exercise behaviour from demographics and exercise identity variables

Predictor Variables	*F*	*df*	*Adj. R^2*	*B*	*SE B*	β	*p-values*	$r_{Y,Xn}$
Step 1	3.03	3, 260	.02					
Age				-0.68	0.94	-0.05	0.47	.00
BMI				-0.32	0.53	-0.04	<0.01	.00
Gender				-8.20	2.73	-0.19	0.54	.03
Step 2	13.93	5, 258	.20					
Age				-0.77	0.85	-0.05	0.37	.00
BMI				-0.41	0.49	-0.05	0.01	.00
Gender				-6.78	2.50	-0.16	0.40	.03
EIS-Role Identity				5.94	1.50	0.31	<0.01	.05
EIS-Exercise Beliefs				3.21	1.70	0.15	0.06	.01

Note: EIS = Exercise Identity Scale. GLTEQ-METS = Godin Leisure Time Exercise Questionnaire omnibus score. $r_{Y,Xn}$ = Unique Variance ($[r_{Y,Xn}]2$ where rY,Xn is the part correlation coefficient controlling for the influence of all other predictor variables in the regression equation; Hair et al., 2006). Adj. R2 = Adjusted R-squared value. A significant F-change was observed in the step 1 ($p < .05$) and step 2 ($p < .01$) of the regression analysis. All p-values reported were based on two-tailed tests of statistical significnace.

Structural Validity of EIS

The evidence supporting the structural validity of responses to the EIS did not unequivocally endorse the measurement model advocated by Anderson and Cychosz (1994) and offered stronger statistical support for a revised 2-factor measurement model consisting of factors capturing role-identity and exercise beliefs. Consistent with calls for repeated assessment of instrument dimensionality in populations of interest (Messick, 1995), the findings presented in this study extend the evidence pertaining to the structural validity of EIS scores in several ways. First, we tested the structural validity of EIS responses in a Canadian sample using CFA procedures that serves as a point of comparison with previous studies that have relied exclusively on American residents (Anderson & Cychosz, 1994; Cardinal & Cardinal, 1997). Second, we examined the plausibility of an alternative configuration of the measurement model underpinning responses to the EIS which holds potential for advancing the assessment of identity, as well as relevant processes central to identity formation and maintenance in the context of exercise. Future research interested in extending the construct validity evidence associated with this instrument may wish to examine the sensitivity of EIS item interpretations across important subgroups of interest such as gender or age-cohorts. This avenue of inquiry would seem prudent given that between groups comparisons of mean EIS scores such as those employed by Anderson et al. (2001) to examine age-related differences in exercise identity can be obfuscated when instruments fail to exhibit measurement invariance (Hoyle & Panter, 1994).

The results of the present investigation make it apparent that there was limited psychometric support for the unidimensional EIS measurement model proposed by Anderson and Cychosz (1994). Joint consideration of the global model fit indices coupled with the low standardized factor loading and large standardized residuals exhibited by EIS item 9 ("Exercising is something I think about often") did not provide convincing support for the unidimensional EIS measurement model. This observation is partially consistent with Anderson and Cychosz's (1994) study of university-students, whereby this EIS item had one of the smallest observed item:total correlations (r_{it}) in the reliability analysis (r_{it} = 0.60; range = 0.55 to 0.87) and a relatively weak loading (0.67; Range = 0.62 to 0.91) on the latent EIS factor retained from the exploratory factor analysis. One plausible explanation for the performance of this EIS item concerns the focus represented by the item content, which appears more closely aligned with ruminations about the behaviour per se rather than the degree to which exercise has been incorporated into one's identity or aligned with the role of being an exerciser. Future studies might do well to test this assertion directly by examining the relevance and representation inherent in the content of each EIS item using the procedures described by Dunn, Bouffard, and Rogers (1999).

One novel finding emerging from this investigation concerns the support for an alternative configuration of the EIS measurement model into a 2-factor structure capturing the salience with which the role of being an exerciser has been assimilated into one's identity accompanied by relevant beliefs about exercise previously linked with the salience and strength of identity perceptions (Strachan et al., 2005). Corroborating support for testing the 2-factor measurement model was evident in the observed modification indices stemming from the unidimensional measurement model analysis, whereby correlating the error terms associated with EIS items 1 ("I consider myself an exerciser") and 6 ("Others see me as someone who exercises regularly") offered the largest improvement in model fit. Gerbing and Anderson (1984) suggest that such modifications can be indicative of residual variance left unaccounted for by the measurement model under examination that warrants the inclusion of additional latent factors. Taken together with Anderson and Cychosz's (1994) original intent to create an instrument capturing the "salience of role-identity" (p.748), it seems reasonable to suggest that the revised 2-factor EIS measurement model is an improved configuration that is consistent with relevant identity theory informing the EIS's development (Stryker & Serpe, 1982; Stryker & Statham, 1985). Nevertheless, the interpretation of within-factor correlated error terms is ambiguous at best (Gerbing & Anderson, 1984), and adjustments stemming from post-hoc modification indices without cross-validation tests can capitalize on chance relationship in sample data that rarely replicate (MacCallum, Roznowski, & Necowitz, 1992). Therefore, it seems prudent to temper conclusions regarding the fidelity of the multidimensional EIS measurement model with caution prior to subsequent replication.

Nomological Validity and EIS

Our study extends previous work examining issues of identity in exercise by situating the EIS in a larger nomological network derived from SDT (Deci & Ryan, 2002) concerning the function of psychological needs. The pattern of relationships evident between fulfillment of basic psychological needs and both role-identity and exercise beliefs make it apparent that feeling more competent, autonomous, and related in the context of exercise is associated with a stronger sense of exercise as an integral portion of one's identity. While this observation is consistent with Ryan and Deci's (2003) assertions pertaining to the function of psychological needs with respect to assimilating identities with the self, it is interesting to note that the pattern of observed relationships varied with perceived competence representing the strongest correlate of both components of exercise identity followed by perceived relatedness with perceived autonomy showing the most heterogeneous pattern of relationships with exercise identity. The salience of competence-based perceptions to identity is consistent with Cast and Burke's (2002) contention that an inability to verify one's role identity (such as an exerciser) within a predefined social structure (such as a reference group of active exercisers) will likely reduce a person's sense of efficacy and acceptance within the reference group.

The observations concerning perceived relatedness and perceived autonomy with reference to role-identity and exercise beliefs presented in Table 3 are more difficult to reconcile. One possible explanation concerns the function of these needs compared with perceptions of competence in relation to the salience of identity formation in exercise settings. It seems reasonable to suggest, for example, that those initiating exercise for the first time will be unlikely to feel that this behaviour represents a salient component of their identity and therefore may need to feel volitional and connected to important referent groups in the early stages of exercise adoption. Conversely, when exercise has been more firmly integrated with the self, it may be that perceptions of agency and security of attachments with others play a less potent role in maintaining one's identity as an exerciser compared to effective functioning in this context. This interpretation is not wholly inconsistent with Ryan and Deci's (2003) contentions that "identity formation is a dynamic process" (p.270), which implies that the relative contribution of basic psychological need fulfillment at various stages of identity assimilation with the self could vary and seems like a worthwhile avenue for additional inquiry.

This investigation offers further evidence for the importance of exercise identity for understanding patterns of exercise behaviour. The results of the multiple regression analysis (see Table 4) make it apparent that a stronger sense of exercise as a portion of one's identity in terms of either role-identity or exercise beliefs is linked with more frequent exercise participation despite the contributions of age, gender, and BMI which have been robustly linked with physical activity (Bouchard et al., 1997). The observed relationship between exercise identity and frequency of participation in exercise behaviours corroborates previous studies (Anderson & Cychosz, 1994; Cardinal & Cardinal, 1997) and points to the importance of understanding why securing exercise as a salient component of one's identity is associated with more adaptive behavioural patterns. Interestingly, it

appears that role-identity holds a stronger predictive relationship with weekly exercise behaviour compared with exercise beliefs suggesting, in line with identity theory, that people behave in a manner consistent with the roles they adopt or integrate into their self-structure (Baumeister & Vohs, 2003; Stets & Burke, 2003). Future studies may wish to extend the present findings by examining the influence of exercise identity over time to elucidate the direction of causal flow between identity and behaviour and consider using qualitative techniques to explore the reasons why more salient exercise identities are linked with patterns of behavioural persistence in exercise.

Limitations and Future Directions

Despite the theoretical and practical appeal inherent in this study, a number of limitations should be acknowledged and future research directions offered to advance the study of identity in exercise using the EIS. First, this study employed purposive sampling techniques that relied on intact groups of young, physically active, healthy university students which ultimately restrict the external validity of our data. Future studies interested in expanding the construct validity evidence of the EIS in line with Messick's (1995) assertions may wish to examine the tenability of both the unidimensional and 2-factor EIS measurement models in other samples where exercise participation is an important issue (e.g., persons with disabilities, older adults). Second, the data reported in this study relied exclusively on self-report methods that remain susceptible to social desirability response bias and contamination from common methods effects (Campbell & Fiske, 1959). Future studies would do well to consider measuring relevant variables using methods other than self-report or employing modifications to Campbell and Fiske's (1959) multitrait-multimethod matrix approach to evaluate patterns of convergence between exercise identity and other psychological constructs without the presence of common methods variance. Finally, this study relied on a non-experimental design, using cross-sectional data that was restricted to measuring a select portion of SDT-based variables that may impact exercise identity. Future studies may wish to embrace longitudinal designs to provide additional insight into the nature of the temporal relationships between satisfactions of psychological need, components of exercise identity, and frequency of exercise behaviour. Consideration of additional SDT constructs may be instructive in terms of building a nomological network with reference to EIS interpretations such as examining the importance of SDT's motivational continuum to the endorsement of exercise as a salient component of one's identity.

In summary, the purpose of this study was to provide evidence informing the structural and criterion validity of EIS scores, as well as examine a plausible nomological network of relationships between responses to the EIS and perceptions of psychological need satisfaction drawn from SDT (Deci & Ryan, 2002) and exercise behaviour. The results of this investigation partially support the construct validity of EIS interpretations given the observation that a stronger sense of exercise identity is associated with greater perceptions of psychological need fulfillment in exercise and more frequent exercise participation across a typical week. While this study provides evidence supporting the

criterion validity of EIS responses and situating the EIS in a larger nomological network derived in part from SDT, it appears reasonable to suggest that the evidence attesting to the structural validity of EIS scores was inconclusive in the present study and requires further attention. Notwithstanding this observation, it does appear reasonable to suggest that the wealth of the available evidence informing the construct validity of responses to the EIS supports continued investigation of measurement and conceptual issues pertaining to identity in exercise contexts. On the basis of the present study, future research in this area may wish to consider embracing SDT as a useful theoretical basis framing further investigations of identity in exercise contexts.

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