Title: Motivation and participation in daily and social activity among adults with spinal cord injury: Applying self-determination theory

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Abstract

Background: Individuals with a spinal cord injury (SCI) report decreased participation in daily and social activities. Self-determination theory (SDT) posits that individuals' need satisfaction and frustration predicts participation in health-related behaviours and motivation moderates the relationship between needs satisfaction/frustration and participation.

Objectives: This study explored the role of psychological needs and motivation in relation to participation in daily and social activities among adults with SCI. It was hypothesized that: a) need satisfaction and need frustration were positively associated with autonomous and controlled motivation, respectively, which, positively and negatively predicted participation in daily and social activities; b) autonomous and controlled motivation mediated need satisfaction and frustration and participation relationship, respectively; and c) need frustration was positively related to amotivation, with no relationship between amotivation and activity participation.

Methods: In this cross-sectional study, adults with SCI (N=131) completed a questionnaire regarding their need satisfaction/frustration, autonomous and controlled motivation and amotivation, and participation in daily and social activities.

Results: Need satisfaction was positively related to autonomous motivation (β =.29, 95%bias-corrected confidence interval (bCI): [.04, .67]) and need frustration to controlled motivation (β =.28, 95%bCI: [.09, .55]). Autonomous motivation was positively associated with six participation categories: autonomous indoor, autonomous outdoor, family role, health, social life, and work/education. Autonomous motivation also mediated the relationship between need satisfaction and all six participation categories; whereas, neither controlled motivation nor amotivation mediated the relationship between need frustration and participation.

Conclusions: This study found that SDT provides a meaningful framework for understanding participation among adults with SCI.

Motivation and participation in daily and social activities among adults with spinal cord injury: Applying self-determination theory

Introduction

The moment an individual sustains a spinal cord injury (SCI), their lives and the lives of those around them are immediately changed. Following an SCI, individuals go through an extensive rehabilitation process offered through hospitals, rehabilitation centres, and community organizations in order to help them adapt to living with their injury (1). Despite this process, many adults with SCI experience challenges in resuming daily and social activities in the years following their injury (2).

These daily and social activities have been framed within the concept of "participation" in the International Classification of Functioning, Disability, and Health (3). Participation is defined as the involvement in life situations (3). Participation in these situations and activities can be categorized into broader domains (4-6). For one, indoor activities involve washing and dressing, performing bathroom activities, going to bed, and eating and drinking (7-8). Outdoor activities touch upon transportation to and from the home and participating in societal and community events (5-6). Family activities include fulfilling roles (i.e., mother, father, etc.) and contributing to household and domestic activities as much as one wants (4, 5, 7); while, health activities include anything that can contribute to overall physical and psychological health (6, 9). Social life activities involve communication with friends, maintaining relationships with a partner, and engaging in frequent contact (4, 7-9). Finally, work and education activities can include being gainfully employed, having the opportunity to pursue education, and having financial independence (4, 6, 8).

Participation in daily and social activities is related to increased quality of life (10), life satisfaction (11), stronger social connections (12), and reduced depressive symptoms (13). Despite these positive outcomes, many adults with SCI report disrupted levels of participation in many areas including employment (14, 15), mobility (14), sexual activity (15), sport and recreational activities (11), and social activities (12), compared to before their injury. As such, participation in these activities remains a significant challenge for many adults with SCI (16). Recent research has demonstrated that improvements to the natural environment, adapted transportation, and available care can help improve participation in daily and social activities for adults with SCI (17). However, our understanding of the reasons why (i.e., motivation) individuals participate in these activities is limited.

Self-determination theory (SDT) is a leading motivational theory that provides insight into how individuals' psychological experiences are related to their motivation and behaviour (18). According to SDT, there are three basic psychological needs (autonomy, competence, and relatedness), which are said to be innate, universal across cultures, and evident in all development periods (18). Autonomy is seen when individuals act in line with their own interests and values, competence is defined as when an individual's interactions allow them to develop their confidence, and relatedness is characterized by a sense of belonging with others. When the psychological needs are satisfied, it will promote an autonomous motivation orientation where they engage in behaviours out of interest or curiosity, or because it is in line with their goals and objectives (18). Autonomous motivation is considered to be optimal since it leads to positive outcomes; such as, increased learning, interest, effort, persistence, performance, life satisfaction, or well-being (19, 20). Alternatively, when the psychological needs are frustrated, it will lead to a controlled motivation orientation where individuals engage in behaviour because they have to,

to avoid guilt, or to achieve a reward (18). Controlled motivation is considered undesirable since it promotes negative outcomes including decreased health, increased exhaustion, burnout, and anxiety (21, 22). Finally, when the psychological needs are chronically frustrated (23), this will promote amotivation where individuals do not see any reason to engage in the behaviour (18). Similar to controlled motivation, amotivation is also associated with negative outcomes (21).

Recently, researchers have begun to take an SDT perspective and have found that SDT is an appropriate framework to further our understanding of the positive and negative outcomes and behaviours that are important for adults with SCI. Saebu, Sorensen, and Halvari examined a group of young adults with physical disabilities (24), including SCI, and found that psychological need satisfaction was positively associated with autonomous motivation for physical activity, which was, in turn, associated with increased participation in physical activity. Similarly, another study demonstrated that autonomous motivation was positively related to the likelihood of meeting the physical activity guidelines among adults with SCI (25). Autonomous motivation for sport was also found to be associated with increased coping skills for wheelchair basketball players with physical disabilities (including SCI) (26). As such, there is empirical and theoretical reasons to suggest that examining adults with SCI's need satisfaction and motivation from an SDT perspective may help further our understanding of participation in daily and social activities. However, no studies have tested an SDT path model linking psychological needs, motivation, and participation in an SCI context.

Present Study

The purpose of the present study was to explore the role of psychological needs and motivation in relation to participation in daily and social activities among a sample of adults with SCI. For this study, we will examine the extent to which participants reported participation in six

categories: autonomous indoor, autonomous outdoor, family role, health, social life and relationships, and work and education activities. As per SDT, we hypothesized that 1) general psychological need satisfaction will be positively associated with autonomous motivation, which will be positively related to reported participation in activities. That 2) need frustration will be positively associated with controlled motivation and controlled motivation will be negatively related to reported participation in activities. For both these hypotheses, we also expect that the respective motivation will act as a mediator between the psychological needs and participation variables. Finally, that 3) need frustration will be positively related to amotivation, but we expect no relationship between reported amotivation and activity participation, as amotivated individuals either lack interest, the desired competence to participate, or see no value in participating (18).

Methods

Participants

Adults living with SCI (N = 131; 27.5% women; M_{age}= 51.4 years (SD = 12.66)) were recruited from an SCI provincial organization responsible for promoting autonomy and quality of life for adults with a physical disability (Table 1). Eligible participants were at least 18 years of age, able to speak and/or read in French or English, and had an SCI for at least one year. They completed the questionnaire either online or over the telephone. Based on the power recommendation of 10 to 20 participants per parameter, a sample of 120 participants was needed for this study (11 parameters in SDT model) (27). This study is a secondary data analysis of the original data that are published elsewhere (28).

Procedure

The organization screened members listed on their contact lists to determine whether they would meet the eligibility criteria. The organization then contacted and directed potential participants to the research team, which were invited to participate online or over the telephone. Those who opted to participate online were provided with a link to the online questionnaire by email, while those who chose to participate over the telephone were connected with a research assistant. The study was approved by authors' research ethics board and all participants provided informed consent prior to completing the questionnaire. After completion, participants were offered a $25 gift card as compensation for their participation.

Measures

Demographic information. Participants provided demographic and SCI related information. Specifically, they provided their age, gender, marital status, education, level of

injury, severity of injury, years since injury, use of adapted public transportation, and ownership of an adapted vehicle.

Participation. The Person-Perceived Participation in Daily Activities Questionnaire (PDAQ) was used to measure participants' participation in daily and social activities (5). The PDAQ was developed for individuals' living with SCI and is used to measure individuals with SCI's extent of participation across 25 activities (5, 6). The construct validity of these items was previously demonstrated (5). In response to the prompt "Do you participate in this activity?", participants selected one of four options: (a) yes, as much as I want; (b) yes, but less than I want; (c) no, but I would like to do it; or (d) no, and I do not want to do it. The two "No" responses were grouped together and labelled as "0", and the two "Yes" responses were labelled as 2 and 1 respectively (6). Participation responses were grouped as such to measure the consequences of participating in the activity, rather than only examining participation versus no participation. The 26 daily activities were divided into six categories of daily and social activities. The six categories were: autonomous indoor participation (6 items; $\alpha = .86$; e.g., dressing and undressing); autonomous outdoor participation (6 items; $\alpha = .78$; e.g., accessing services in your community); family role (4 items; $\alpha = .67$; e.g., preparing meals); health (2 items; $r = .23$; e.g., maintaining physical health); social life and relationships (4 items; $\alpha = .60$; e.g., communicating with others by electronic means); and work and education (3 items; $\alpha = .67$; e.g., carrying-out productive activities that you are paid for). For the purposes of the present study, the sum of each category's scores were calculated and used to represent that construct in the model. Low scores indicate little-to-no participation; whereas, higher scores indicate participation in activities as much as one wants.

Psychological needs. Participants responded to the Balanced Measure of Psychological Needs scale to assess satisfaction and frustration of the three basic psychological needs (29). They responded on a 5-point scale (1 = completely disagree; 5 = completely agree) to 18 questions, with three items per subscale, six per basic psychological need. The means were calculated for the satisfaction and frustration of autonomy (e.g.., I was free to do things my own way; α=.71; e.g., there were people telling me what I had to do; α=.57), relatedness (e.g., I felt close and connected with other people; α=.85; e.g., I was lonely; α= .63), and competence (e.g., I took on and mastered hard challenges; α=.90; e.g., I experienced some kind of failure; α= .67). The means of each psychological need score were taken to calculate a need frustration score (α= .74) and a need satisfaction score (α= .83).

Motivation. The Global Motivation Scale-28 was used to measure participants' autonomous motivation, controlled motivation, and amotivation towards behaving in their life as a whole. Individuals' responded to 28 questions on a 7-point scale (1 = does not correspond accordingly; 7 = corresponds completely) (30). The 28 items were broken down into seven subscales, each containing four items. Autonomous motivation (α= .89) was calculated as the mean score of individuals' intrinsic motivation to know (α= .90; e.g., "in general, I do things for the pleasure of acquiring new knowledge"), intrinsic motivation towards accomplishment (α= .89; e.g., "in general, I do things for the pleasure I feel mastering what I am doing"), intrinsic motivation to experience stimulation (α= .87; e.g., "in general, I do things for the enjoyable feelings I experience") and identified extrinsic motivation (α= .69; e.g., "in general, I do things because I choose to invest myself in what is important to me"). Controlled motivation (α= .66) was calculated from the mean of introjected extrinsic motivation (α= .78; e.g., "in general, I do things because I would feel bad if I did not do them"), and external regulation extrinsic

196 motivation (α= .78; e.g., “in general, I do things in order to attain prestige”). A mean for
197 amotivation (α= .84) was also calculated from four items (e.g., “in general, I do things even
198 though I believe they are not worth the trouble”).

199 **Data Analysis**

200 Data were cleaned and model variables were screened for univariate outliers, distribution
201 normality, and the degree of missing data was assessed. Univariate outliers were identified by
202 examining standardized distributions and then recoding problematic scores to one unit higher or
203 lower than the next acceptable value ($Z<\pm3.29$) (31). Next, the data distributions of all study
204 variables were examined for normality by examining the skewness and kurtosis ratios. Finally,
205 missing data was estimated in Mplus using maximum likelihood estimation, as long as
206 participants were not missing all data points across the variables of interest[1] (32).

207 A path analysis was conducted using Mplus 7.3 statistical software to test all three
208 hypotheses (32). Results were reported using 1000 bootstrap 95% bias-corrected confidence
209 intervals (bCI) as the indicator of significance. bCIs are confidence intervals that correct for the
210 bias between the bootstrap condition and the sample. Significance is determined when the 95%
211 bCI does not cross 0, equivalent to $p<.05$. Bootstrapping was used as it reduces type 1 error,
212 provides more accurate 95% bCIs than non-bootstrapped estimated confidence intervals, and is
213 more robust against non-normal data, which is common in social science research (33). We also
214 examined the indirect effect of need satisfaction and need frustration on all six participation
215 categories through autonomous motivation, controlled motivation, and amotivation. The

[1] There were 35 participants missing between one to three observations on the model variables (mainly on the outcomes). To ensure that the missing data imputation was not biasing the results, we ran the analyses without the 35 participants to confirm that the model still held. The model had excellent fit ($\chi^2_{(12)} = 10.644$, $p = 0.5597$; CFI = 1.000; TLI = 1.031; RMSEA = 0.000, 90%CI: [0.00, 0.09]; SRMR = 0.033) and all of the same relationships held. To preserve the integrity and power of the larger sample, we opted to continue to report the results using the imputed data.

following indices used were to determine model fit: chi-square goodness-of-fit indices ($p < .05$), Comparative Fit index (CFI), Tucker-Louis Index (TLI), Root Means Square of Error of Approximation (RMSEA), Standardized Root Mean Residual (SRMR). The cut off criterion for excellent model fit were designated as: CFI and TFI >.95, and RMSEA and SRMR <.06.

Results

No univariate outliers were found and the skewness and kurtosis ratios suggested that need satisfaction, need frustration, autonomous motivation, autonomous indoor participation, social life and relationship participation, and work and education participation were skewed (see Table 2). However, no transformations were made to the variables since bCI is robust against non-normality and the analyses proceeded as planned. Missing data were equal to 6.3%. Finally, before proceeding with the full model testing, all model variables were correlated to observe the zero-order relationships between each variable (Table 2).

Model Testing

The tested SDT path model had excellent model fit ($\chi^2_{(12)} = 12.046$, $p = 0.4420$; CFI = 1.000; TLI = 0.999; RMSEA = 0.005, 90%CI: [0.00, 0.09]; SRMR = 0.038) and explained 4.0% to 17.0% of the variance in participation in the six daily and social activities (see Figure 1).

Hypothesis 1. Need satisfaction was a significant predictor of autonomous motivation (β = .55, 95%bCI: [.11, .65]) and autonomous motivation predicted all six participation variables: autonomous indoor participation (β = .20, 95%bCI: [.05, 1.26]); autonomous outdoor participation (β = .33, 95%bCI: [.49, 1.48]); family role participation (β = .31, 95%bCI: [.29, .91]); health participation (β = .23, 95%bCI: [.04, .42]); social life and relationship participation (β = .17, 95%bCI: [.03, .54]); and work and education participation (β = .23, 95%bCI: [.06, .77]). Significant indirect effects were found between autonomous outdoor participation and need satisfaction (β = .41, 95%bCI: [.02, .22] and family role participation and need satisfaction (β = .10, 95%bCI: [.003, .20]).

Hypothesis 2. Need frustration was a significant predictor of controlled motivation (β = .34, 95%bCI: [.15, .78]). However, controlled motivation was not a significant predictor of any of the six participation variables (Figure 1).

Mediation. When examining the mediation relationship for both hypothesis 1 and 2, autonomous motivation was a significant mediator of the relationship between need satisfaction and the six participation categories: autonomous indoor participation (indirect effect: b = .25, 95%CI: [.02, .75]; β = .07); autonomous outdoor participation (indirect effect: b = .38, 95%CI: [.08, .78]; β = .11); family role participation (indirect effect: b = .24, 95%CI: [.05, .53]; β = .11); health participation (indirect effect: b = .09, 95%CI: [.01, .23]; β = .08); social life and relationship participation (indirect effect: b = .10, 95%CI: [.01, .29]; β = .06); and work and education participation (indirect effect: b = .17, 95%CI: [.02, .42]; β = .10). Both controlled motivation and amotivation were not significant mediators of the psychological need-participation relationship.

Hypothesis 3. Need frustration was not a significant predictor of amotivation; however, amotivation negatively predicted work and education participation (β = -.18, 95%bCI: [.06, .77]).

Discussion

The purpose of this study was to explore the role of psychological needs and motivation in relation to participation in daily and social activity among adults with SCI. Taken together, SDT appeared to be a viable framework to understand participation in daily and social activities in this population. In line with SDT, psychological need satisfaction and autonomous motivation were indirectly and directly related to positive outcomes (i.e., all six participation variables), and psychological need frustration was negatively associated with controlled motivation, while having no relationship with amotivation.

The significant mediation of autonomous motivation on the need satisfaction-participation in daily and social activities relationship was also in line with past research. For instance, Saebu et al. demonstrated that autonomous motivation mediated the relationship between the psychological needs and physical activity among adults with a physical disability (25). Contrary to our hypotheses, controlled motivation was not significantly related with participation in any daily and social activities nor a mediator of the relationship between need frustration and participation. It is plausible that these non-significant relationships were due to the positive nature of participating in daily and social activities. Previous research have also found no relationship between controlled motivation and other positive outcomes, such as physical activity (34). Significant relationships may have been found if we assessed negative outcomes related to low levels of participation such as social isolation, low psychological health, and/or burnout (23). For instance, controlled motivation, and not autonomous motivation, was found to be related to negative outcomes in nurses' job-related outcomes such as psychological distress and psychosomatic complaints (35). Unfortunately, we have little insight into the

relationship between controlled motivation and negative outcomes among adults with SCI, warranting future research.

As expected, need frustration did not predict amotivation. As explained by Sheldon and Gunz, amotivation may only develop after chronic need frustration (24). Given our measure and cross-sectional design, we were unable to test chronic need frustration. We did find a negative relationship between amotivation and work and education participation, when no relationship was hypothesized. In other populations, amotivation was found to have a negative relationship with perseverance in education (36). Decreased participation in work/education may be a result of individuals not seeing a value in the activity, thus being amotivated. Understanding why individuals with SCI would be amotivated for work/education is an important avenue of research as economical, social, and personal benefits appear to emerge from being employed (37).

Theoretical implications and practical applications

This study was the first to examine the role of SDT on daily and social participation among adults with SCI. It supported SDT is a viable framework for understanding the motivation for participating in daily and social activities among adults with SCI. From our results, autonomous motivation appeared to play a role in understanding behaviours among adults with SCI and thus needs further attention within the physical disability literature. To our knowledge, we were also the first to study the role of need frustration among this population. Need frustration predicted controlled motivation, but additional research is needed to fully understand the entire theoretical path. Overall, this study supported SDT, especially need satisfaction and autonomous motivation, for SCI research and to understand these participation outcomes.

The mediating role of autonomous motivation on the need satisfaction-participation relationships can inform future practice. Given the importance of interpersonal behaviours and

social context in supporting need satisfaction, interventions could be designed to support the basic psychological needs of adults with SCI (19). SCI peer mentors appear to provide a need supportive environment which promotes need satisfaction in adults with SCI (28). Sport coaches are also in an opportune position to provide need supportive behaviours (38), and, when provided, parasport athletes take notice of the supportive behaviours (39). Finally, informal caregivers for adults with SCI could also receive training to create a need supportive context for their care receiver. Informal caregivers may require SDT-based interventions to enhance their own sense of autonomy, competence, and relatedness while caring for their care recipient, as suggested by Kitter and Sharman (40).

Limitations and future research

The cross-sectional design of this paper limits our ability to infer any causation. The results, however, are encouraging for future research to create interventions aimed to foster need satisfaction and autonomous motivation to promote participation in daily and social activities. We assessed the SDT constructs from a global perspective (i.e., what participants generally feel). The relationships between constructs could be strengthened if the SDT variables were specific to each participation variables. However, participant burden would have to be considered given the number of behaviours being assessed in the participation measure. Although our sample was relatively large for SCI research, the sample size still required us to collapse the psychological needs and the motivation variables to their broader concepts to build a full SDT model. Future research with larger samples could examine whether the specific basic psychological needs and motivational regulations have unique relationships with daily and social participation among adults with SCI.

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454

455 **Figure Legends**
456

457 Table 1: Demographic information.

458

459 Table 2: Table 2: Descriptive statistics of model variables.

460 Note: * = p<.05, ** = p<.001.

461

462 Figure 1: SDT model of the relationships between need satisfaction and frustration and

463 participation.

464 Note: Only showing significant β relationship (95% bCI does not cross 0, equivalent to p<.05).

465

Table 1: Demographic information.

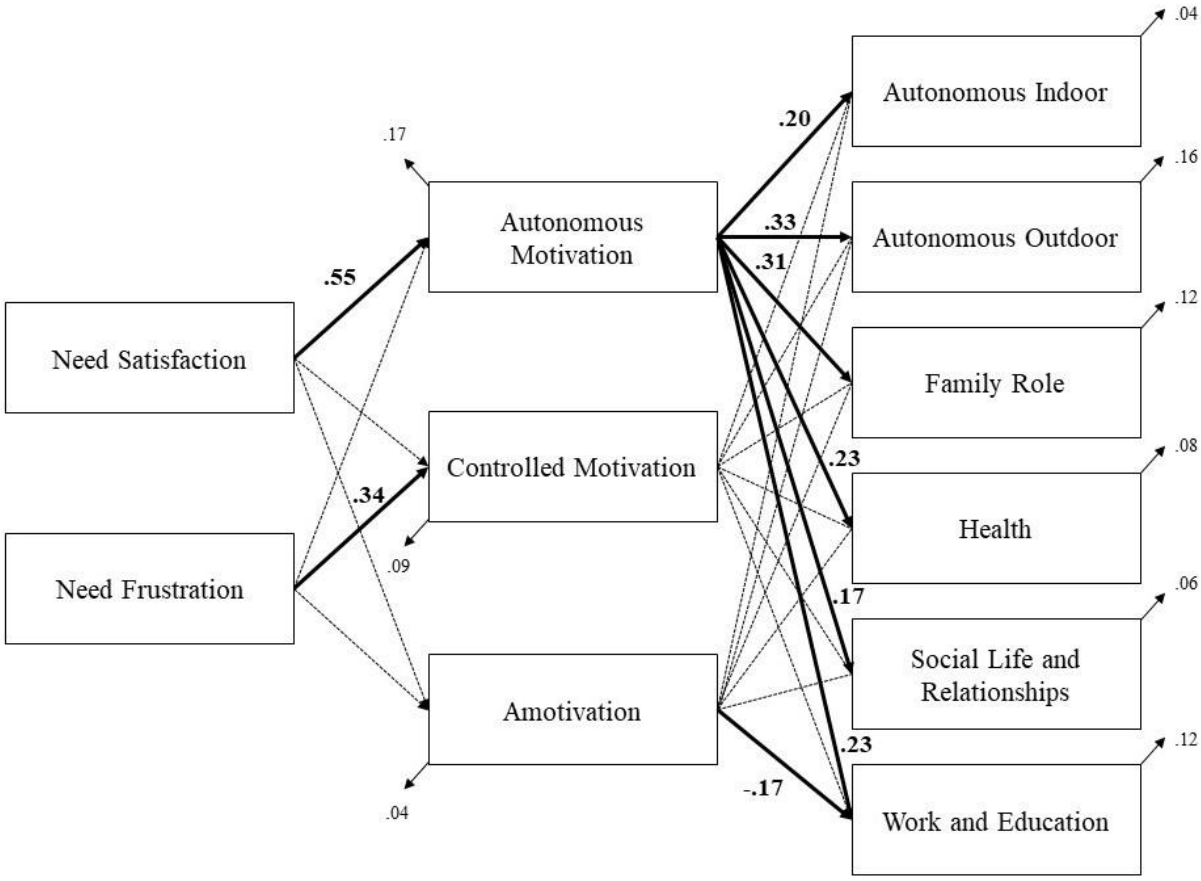
Continuous variables	Mean (SD)
Age	51.4 (12.7)
Years since injury	18.5 (13.2)
Categorical variables	**n (%)**
Gender	
Male	94 (72)
Female	36 (28)
Ethnicity	
White	126 (96)
Other	5 (4)
Marital Status	
Single/Divorced/Widowed	70 (53)
Married or Common law	61 (47)
Education	
High School or lower	52 (40)
Post-secondary	78 (60)
ASIA classification	
A	57 (44)
B	8 (6)
C	20 (15)
D	27 (21)
E	3 (2)
Level of injury	
Tetraplegia	61 (47)
Paraplegic	67 (51)
Adapted house	
Yes	22 (17)
No	109 (83)
Mobility Aid	
Power wheelchair	27 (21)
Other	103 (79)
Adapted public transportation	
Yes	24 (18)
No	105 (80)
Adapted vehicle	
Yes	46 (35)
No	85 (65)

469 Table 2: Descriptive statistics of model variables.

Variables	Mean	Standard deviation	Range	Skewness ratio	Kurtosis ratio	1	2	3	4	5	6	7	8	9	10	11
Need satisfaction	3.64	.91	4.00	-2.68	-0.33	-										
Need frustration	2.27	.83	3.89	3.43	0.39	-.57**	-									
Autonomous motivation	5.45	1.03	5.45	2.11	-0.98	.40**	-.30**	-								
Controlled motivation	3.69	1,25	5.38	-0.68	-1.41	-.16	.30**	.03	-							
Amotivation	2.93	1.43	5.50	-3.68	1.09	-.16	.19*	-.17	.30**	-						
Autonomous indoor	11.18	3.30	12.00	-6.06	1.73	.18*	-.15	.19*	-.05	-.03	-					
Autonomous outdoor	7.56	3.07	12.00	-0.79	-1.60	.26**	-.14	.38**	0.11	-.23*	.27**	-				
Family role	4.68	2.08	8.00	-0.82	-2.06	.27**	-.22*	.30**	-.16	-.10	.49**	.45**	-			
Health	2.56	1.08	4.00	-1.02	-1.29	.19	-.24*	.28**	-.03	-.19	.23*	.51**	.40**	-		
Social life and relationship	6.51	1.53	7.00	-5.15	3.72	.23*	-.12	.22*	-.05	-.19	.27**	.43**	.35**	.38**	-	
Work and education	2.07	1.99	6.00	3.11	-1.21	.09	-.05	.29**	-.13	-.25*	.27**	.55**	.42**	.27**	.32**	-

470 Note: * = p<.05, ** = p<.001.

Figure 1: SDT model of the relationships between need satisfaction and frustration and participation.



Note: Only showing significant β relationship (95% bCI does not cross 0, equivalent to p<.05).