

## Exploring Perceived Sociocontextual Variables and Basic Psychological Needs Satisfaction within Adult Group Exercise Classes

By Sèverine Lanoue\*  
Jean-François Desbiens†  
Vincent Grenon‡  
François Vandercleyen<sup>+</sup>

*How do professionals' behaviors and physical activity (PA) contexts relate with the motivational processes in adult recreational PA? Based on self-determination theory (SDT), this study investigates relationships between personal characteristics, environmental characteristics, sociocontextual variables (autonomy support, structure and involvement) and basic psychological needs satisfaction (autonomy, competence and relatedness) in various adult PA groups. A sample constituted of 452 adults, enrolled in 44 different groups of PA, answered a questionnaire regarding sociocontextual variables and basic psychological needs. Comparative analysis and multiple regressions were used to explore relationships between the targeted variables. The results suggest that significant differences exist between some of the characteristics considered (e.g. participants' age, frequency of PA, classes level of difficulty) and that a complex web of relationships surrounds the motivational processes in PA. For instance, the class level of difficulty and group size are positively related to autonomy support while instructors' certification and instructors' experience are negatively related to that same variable. Meanwhile, class type is positively related while group size is negatively related to involvement. Furthermore, instructors' gender and participants' age are negatively related to competence, whereas participants' PA frequency is positively related to competence. Finally, class type is negatively related to relatedness while participants' age and perceived instructor involvement are positively related to relatedness. This study supports the SDT postulate that sociocontextual variables are associated with basic psychological needs satisfaction. However, it also shows that the sociocontextual variables should not be conceptualized as an ensemble, like many previous studies have proposed, mainly because personal and environmental variables seem to interact with these individual variables. Therefore, when leading groups, professionals in PA contexts must consider many characteristics, such as participants' age or group size, in order to adapt their behaviors regarding autonomy support, structure and involvement. This gives them the ability to support their participants' motivational processes.*

**Keywords:** *Self-determination theory, basic psychological needs, sociocontextual variables, physical activity, adults.*

---

\*PhD Candidate, Université de Sherbrooke, Canada.

†Tenure Professor, Université de Sherbrooke, Canada.

‡Associate Professor, Université de Sherbrooke, Canada.

<sup>+</sup>Associate Professor, Université de Sherbrooke, Canada.

## Introduction

Physical activity (PA) has several physical and psychological benefits such as better cardiovascular health and lower stress (Lee et al. 2012). Close to 80% of Canadian adults are not sufficiently active, meaning that they do less than 150 minutes of weekly moderate-to-vigorous-intensity physical activity (Statistics Canada 2015a). The 2014 Canadian Community Health Survey reported that 48.5% of the population aged 20 and older was considered inactive (Statistics Canada 2015b). Other adults are simply in and out of PA programs and seem unable to maintain their commitment toward PA (Biddle 2007). Annesi (2003) reported that between 40% and 65% of participants drop out during the first three to six months, depending on the PA program.

Many personal (for example: age, time, priorities), environmental (for example: neighborhood quality, facilities, traffic) and social (for example: social support, social norms) factors have been demonstrated to have effects on adult PA participation (Ebben and Brudzynski 2008, McNeil et al. 2006). Many of the factors at stake cannot be controlled by PA professionals such as one's personal priorities, traffic in a neighborhood or family support. Still, how professionals behave with clients has been reported to have an important role in adult participants' adherence to PA (Bray et al. 2005, Brown and Fry 2013, Hannus and Laev 2011, Huberty et al. 2008, Huddleston et al. 2012, Turner et al. 1997, Wininger 2002). For instance, Huberty et al. (2008) showed that the most important perceived behaviors for participants' motivation were: offering support and reinforcement, being aware of the fitness level, providing alternative exercises, acknowledging efforts and success, and making the activity fun. Also, it has been shown that instructors who used a positive leadership style (which includes behaviors such as: positive reinforcement, individualized feedback) in aerobic classes have a direct effect on participants' level of pleasure, sense of self-efficacy, intensity of engagement and intention to remain physically active (Bray et al. 2005, Turner et al. 1997). Similar results indicate that a task-involving climate (which includes behaviors such as: encouraging improvement, fostering cooperation) has positive effects on intrinsic motivation, perceived competence, commitment and enjoyment (Brown and Fry 2013, Huddleston et al. 2012). Overall, this study is based on one rather professionally-oriented question with important theoretical implications: how do instructors' behaviors can better support motivation in group-based PA?

## Self-Determination Theory

Self-determination theory (SDT) (Deci and Ryan 1985) is a contemporary approach of growing interest for intervention design and understanding of the motivational process in PA (Duda et al. 2014, Wilson et al. 2008). This macro theory of human motivation helps define motivation, but furthermore helps identify and understand its essential interacting elements (Deci and Ryan 1985, Vallerand et al. 2008). Namely, SDT suggests that social context influences

behavior through its influence on basic psychological needs satisfaction and motivation (Deci and Ryan 1985, 2008). One strength of the use of SDT in PA contexts lays in the operationalized definitions of variables such as social context and basic psychological needs, which make this theory easily transferable to professional situations.

Motivation is what moves someone to action (Deci and Ryan 1985). It can be defined as a construct mainly observed through specific behaviors such as involvement and adherence (Brunel et al. 2004). SDT identifies three different forms of motivation: intrinsic motivation, extrinsic motivation and a motivation (the absence of motivation). The level of motivation depends on the degree of internalization, namely, the process through which a person integrates or endorses values or behaviors (Deci and Ryan 1985, Ryan and Deci 2000). When the behavior is perceived as autonomous, the degree of internalization is higher and leaning toward a more internalized form of regulation (identified regulation or integrated regulation) or intrinsic motivation, but when the behavior is perceived as controlled, the degree of internalization is low and trending toward a more externalized form of regulation (interjected regulation or external regulation) (Deci and Ryan 1985, Ryan and Deci 2007). Usually in PA context, professionals are working to help clients develop more internalized forms of motivation since it has been demonstrated that these forms of motivation are positively linked with long-term adherence to healthy behaviors (Deci and Ryan 2008). Since it is the main construct of SDT, much attention has been given to the level of motivation toward PA. However, the social context defined by three sociocontextual variables and basic psychological needs seems to have received less direct attention (Teixeira et al. 2012, Wilson et al. 2008).

### *Sociocontextual Variables*

SDT specifies three sociocontextual variables: autonomy support, structure and interpersonal involvement. Autonomy support refers to helping individuals to recognize that they have choices, that they can act without pressure and that they are encouraged to take initiatives (Deci et al. 1994, Smith et al. 2015, Tobin 2003). For example, a fitness instructor can support participants' autonomy by providing options and encouraging participants to make decisions (Edmunds et al. 2009, Smith et al. 2015, Tobin 2003). Structure refers to the instructor's capacities to explain tasks, expectations and goals clearly as well as to provide guidance and positive specific feedback (Deci et al. 1994, Smith et al. 2015, Tobin 2003). In order to show structure, an instructor must demonstrate leadership, make sure that the participants understand the exercises and help them feel confident by giving appropriate feedback (Edmunds et al. 2009, Tobin 2003). Interpersonal involvement refers to the willingness to dedicate psychological resources as well as to the quality of the relationship established between the instructor and the participants (Edmunds et al. 2008). This means that the instructor has to give time to each participant, recognize him or her and demonstrate empathy and interest for his or her well-being (Edmunds et al. 2009, Smith et al., 2015, Tobin 2003). For example, an instructor can spend time

welcoming participants at the beginning of the class and, through that short talk, progressively get to know their goals, needs and interests. Much SDT based research done to date has considered social context as one variable instead of three distinct sociocontextual variables. The terms “social context” or “autonomy supportive behavior” are used as more general terms to report on the sociocontextual variables. This global term may be the result of the unidimensional factorial structures of some of the research instruments used (ex: *Health-care climate questionnaire* (HCCQ) (Williams et al. 1996), *Perceived autonomy support scale for exercise settings* (PASSES) (Gillet et al. 2010, Hagger et al. 2007). The use of a global concept limits the practical applications made possible by SDT operationalized sociocontextual variables. The present study aims to use an instrument to be able to analysesociocontextual variables individually.

### *Basic Psychological Needs*

SDT postulates that there are three essential basic psychological needs to satisfy in order to promote well-being (Deci and Ryan 2002, Wilson et al. 2008). Those are the need for autonomy, the need for competence and the need for relatedness. The need for autonomy refers to how people choose and initiate their actions with a full sense of making their own decisions (Deci and Ryan 1985, Landry and Solmon 2002). It is the feeling of being in control of one’s behavior and acting accordingly with one’s interests and values (Ryan and Deci 2002). The need for competence is based on the person’s belief that he or she is able to produce the desired result through his or her actions (Landry and Solmon 2002, Reis et al. 2000). It is the feeling of being effective in one’s interactions with the environment and having the opportunity to express one’s abilities and skills (Ryan and Deci 2002). Finally, the need for relatedness refers to feeling meaningful connection with the surrounding people (Gillet et al. 2008). It is the sense of closeness with others through the sharing of values and interests (Deci and Ryan 2002, Landry and Solmon 2002).

### **Research on Sociocontextual Variables and Basic Psychological needs in Physical Activity**

Evidence of associations between sociocontextual variables and basic psychological needs can be found in studies in physical education contexts (for example: Lochbaum and Jean-Noel 2016, Rutten et al. 2012, Ommundsen and Kvalø 2007) or in sport contexts (for example: Gillet and Rosnet 2008, Gagné et al. 2003, McDonough and Crocker 2007, Reinboth and Duda 2006). Nonetheless, this relationship has been less studied in the specific context of recreational PA with healthy adults.

Still, research in PA with adults has demonstrated that the sociocontextual variables are associated with basic psychological needs satisfaction. Several studies, if not all, concluded that social context is positively related to each of the three psychological needs (Edmunds et al. 2006, Edmunds et al. 2008, George

et al. 2013, Kinnafick et al. 2014, Markland and Tobin 2010, Moustaka et al. 2012, Puente and Anshel 2010, Silva et al. 2010, Sweet et al. 2012, Sweet et al. 2014, Tobin 2003, Vlachopoulos and Karavani 2009). Also, studies investigating PA interventions indicate that a supportive social context has positive effects on basic psychological needs satisfaction (Edmunds et al. 2008, Kinnafick et al. 2014, Moustaka et al. 2012, Puente and Anshel 2010, Sweet et al. 2014). Furthermore, it seems that in several studies, social context demonstrates a larger effect on relatedness (Edmunds et al. 2006, George et al. 2013, Markland and Tobin 2010, Sweet et al. 2012), while fewer studies have found a larger effect on autonomy (Kinnafick et al. 2014, Vlachopoulos and Karavani 2009). Still, none seems to report a larger effect on competence. Even though studies have reached the same global conclusion – they all agree that social context is related to psychological needs – the differences observed between their results underline the need to investigate further. These differences might be caused by the varying tools and samples, or might be indicators of different processes depending on other variables (for example: participants' personal characteristics, environmental characteristics).

Even though the three needs are essential to developing intrinsic motivation, the level of satisfaction depends on both the individual and the context (Vallerand 2000). This is one good reason to further explore the relationships between sociocontextual variables and basic psychological needs while considering distinctive characteristics of individuals and contexts. In fact, the small samples used in most studies do not allow researchers to consider and compare variables regarding the participants (e.g. gender, age), the instructors (e.g. gender, experience) or the PA characteristics (e.g. type of PA, level of difficulty). It is also noteworthy that actual research examines social context as one variable and does not consider individual sociocontextual variables. In other words, the social context is considered without any discrimination between autonomy support, structure and interpersonal involvement. Only one research in PA with adults was found studying the three sociocontextual variables individually (Edmunds et al. 2008). This study found only one significant positive association between structure and competence (Edmunds et al. 2008). This result leaves open questions about the weight of each sociocontextual variable in the previously established relationships between the social context concept and basic psychological needs. Therefore, limited knowledge exists about the specific relationships between the three individual sociocontextual variables and the three basic psychological needs. Aside from the contribution to the empirical and theoretical literature on the subject, the study of the three individual sociocontextual variables can provide results with direct practical applications.

The main purpose of this study was to investigate the relationships between the perceived sociocontextual variables and basic psychological needs satisfaction with consideration of participants', instructors', and PA classes characteristics in diverse groups with healthy adults. Even if professional hypotheses could be made based on the authors' professional experiences, no hypothesis will be presented before data analysis since too little scientific information is available for some of the variables explored in this study. This article aims to: 1) compare

the perceived sociocontextual variables and basic psychological needs satisfaction according to participants' characteristics (age, gender, PA frequency), instructors' characteristics (gender, experience, certification) and PA characteristics (type of class, level of difficulty, number of participants); 2) examine relations between the targeted characteristics and perceived sociocontextual variables; and 3) examine relations between the targeted characteristics, perceived sociocontextual variables and basic psychological needs satisfaction.

## Methodology

### *Sample*

Data were collected from 452 participants (409 women, 37 men and 6 unspecified) involved in PA classes. Participants were between 17 and 86 years old with an average of 49.23 ( $SD = 15.10$ ) and a median of 52 years old. The reported PA frequency varied between 1 and 12 times per week with an average of 3.41 ( $SD = 1.57$ ) and a median of 3 times per week. Participants were recruited from eight different PA businesses and they were registered in one of the 44 different classes led by 44 different instructors. Four different types of PA groups were identified through class descriptions: indoor PA with predetermined content from specialized programs ( $n = 133$ ), indoor PA planned by the instructors ( $n = 99$ ), outdoor PA planned by the instructors ( $n = 98$ ) and stretching or posture classes ( $n = 122$ ). Also, two different levels of difficulty were determined: classes open to all ( $n = 364$ ) and intermediate/advanced classes ( $n = 88$ ). The number of participants per group varied from 4 to 51 with an average of 12.20 ( $SD = 8.87$ ) and a median of 10 participants. The instructors (39 women and 5 men) had an average of 7.65 ( $SD = 9.23$ ) years of experience and yet, a median of only 3 years of experience. All of them were certified trainers; 29 instructors had a university degree or were attending university and 15 detained private certifications.

### *Measures*

An information form was specially built for the purpose of this study. That form collected information about the class, such as the name and the formal description given by the organizations. Afterward, this information was used to establish the four class types and the two levels of difficulty previously mentioned. The number of participants attending the class at the moment of the data collection was also reported. As for the instructors, the form collected information on their gender, on their number of years of experience as an instructor of PA classes and on the kind of certifications they were holding.

The participants' questionnaire included questions about their gender, their age and their weekly involvement in PA. Also, it collected data on participants' perceptions of sociocontextual variables and basic psychological needs satisfaction.

To measure the sociocontextual variables, the “Perceived Environmental Supportiveness Questionnaire” (PESQ) was used. That instrument was developed and validated by Tobin (2003) and was previously used by Edmunds et al. (2008). The PESQ has demonstrated the ability to individually address each of the sociocontextual variables, what other instruments could not do because of their unidimensional structure. The PESQ was translated in French and validated by our research team following recommendations made by Vallerand (1989). This questionnaire used 12 items considering the three sociocontextual variables (autonomy support, structure and involvement). Participants had to indicate their level of agreement with each item on an ordinal scale ranging from 0 (not at all true) to 4 (completely true).

Basic psychological needs satisfaction was measured using “L'échelle des besoins psychologiques fondamentaux en sport” (ÉBPFS) (Basic Psychological Needs Satisfaction Scale in Sport, authors' translation) developed and validated by Gillet et al. (2008). This scale uses 15 items covering the three needs (autonomy, competence, relatedness). Subjects had to indicate their level of agreement with each item on an ordinal scale ranging from 1 (not at all true) to 7 (completely true). For the purpose of this study, the terms “sport” and “training program” were replaced with “physical activity”.

When examining psychometric properties, the results of the factor analysis for both questionnaires showed low factor loadings and complex items (Lanoue et al. 2017). Considering those results, the need for autonomy and the sociocontextual variable of structure were not included in the following analyses. Cronbach's alpha (see table 1 for specifics) for the remaining variables are at a satisfactory level above .70 (Panayides 2013).

### *Procedure*

After receiving the approbation of the ethics committee, researchers first contacted PA organizations from a French-Canadian city that offers fitness and PA classes. That created a convenience sample of organizations, but since the research participants were their employees and their clients, voluntary collaboration was necessary. A formal engagement was signed between organizations and researchers. Afterward, the businesses informed their instructors that a member of the research team would contact them to seek their participation in the project. The classes/instructors were selected through quota sampling to represent the actual businesses offer of various PA types. When contacting the instructors, the study was explained. If the instructor agreed to participate, a consent form and the information form were filled. Then, the date, time and place were scheduled so that a researcher could recruit participants in the classes. When visiting at the end of the classes, this same researcher explained the project and the questionnaire to participants. Volunteer participants, who agreed to participate by implied consent, filled in the anonymous questionnaire.

### Analysis

Using IBM SPSS 20.0 (2011) psychometric properties of the instruments were first examined as well as sample size adequacy and normality of distributions (Tabachnick and Fidell 2007). Subsequently descriptive analyses and Pearson's correlations were computed (table 1). For the purpose of comparative analyses, the grouping of continuous variables (age, class size and instructors' experience) was based on data distribution and used percentiles to provide three or four categories of similar size (N). The grouping of weekly involvement in PA was also based on data distribution using the median. The class type and class level of difficulty were categorized according to the analysis of the classes descriptions provided by the different organizations. Finally the instructors' certification revealed only two possible categories.

To explore if the participants' characteristics, classes characteristics and instructors' characteristics contributed to significant differences, Student t-tests and ANOVA with Tukey's post hoc (Howell 2004) were used to compare average scores of perceived sociocontextual variables and basic psychological needs satisfaction (table 2). Student t-tests were used for the following variables: participants' gender, classes' level of difficulty, instructors' gender and instructors' certification. ANOVA's were used for the remaining variables: participants' age, participants' weekly involvement in physical activity, classes' type, classes' size and instructors' experience.

In addition, to explore relations, multiple regression analyses (figure 1) were conducted using a backward procedure (Howell 2004). This procedure starts with all the independent variables and eliminates one by one those which are non-significant, until a final model is found in which all the remaining predictive variables are statistically significant. The backward procedure simplifies the equation and thus facilitates interpretation. With the exploratory purpose in mind, participants' characteristics, instructors' characteristics and classes' characteristics were examined as predictors for each sociocontextual variable (figure 1A and 1B). Finally, characteristics and perceived sociocontextual variables were tested as predictors for each of the basic psychological needs (figure 1C and 1D).

### Results

Table 1 reports means and standard deviations from which one could suspect asymmetric distributions for competence, relatedness, autonomy support and involvement. The asymmetric distributions were confirmed with Shapiro-Wilks tests (Razaliand Wah 2011). Significant correlations are also reported in table 1.

**Table 1.** Descriptive Results, Internal Consistency and Pearson's Correlations

	Variables	Mean	SD	Alpha	1	2	3	4
1	Competence	4.47	1.61	.73	-			
2	Relatedness	5.94	0.79	.79	-.01	-		
3	Autonomy support	3.55	0.70	.83	.02	.28**	-	
4	Involvement	3.44	0.70	.90	-.04	.42**	.56**	-
5	Age	49.23	15.10	-	-.31**	.16**	.02	.14*
6	PA frequency	3.41	1.57	-	.19**	.05	.01	-.03
7	Nb participants	12.2	8.87	-	.05	-.02	.05	-.17**
8	Inst. experience	7.65	9.23	-	-.07	-.01	-.12*	.01

Notes: \*  $p < .05$  ; \*\*  $p < .01$

PA: physical activity, Nb: number, Inst.: instructor's, SD: standard deviation

Table 2 reports on the significant differences of perceived sociocontextual variables and basic psychological needs satisfaction for each characteristic considered in this study. Both perceived sociocontextual variables do not differ for participants' gender (autonomy support:  $t_{(437)} = 1.07$ ,  $p = .288$ ; involvement:  $t_{(437)} = 1.61$ ,  $p = .108$ ) and instructors' gender (autonomy support:  $t_{(437)} = 1.97$ ,  $p = .050$ ; involvement:  $t_{(437)} = 0.02$ ,  $p = .989$ ). Autonomy support shows significant differences indicating lower scores in classes with level of difficulty "open to all" ( $t_{(437)} = -2.36$ ,  $p = .018$ ). Results also suggest lower perceived autonomy support when instructors have more than 11 years of experience compared to instructors with 3 to 10 years of experience ( $F_{(2,436)} = 4.01$ ,  $p = .019$ ).

For perceived instructors' involvement, significant results indicate higher scores for participants aged between 53 and 62 years old than for participants aged under 35 years old ( $F_{(3,434)} = 3.37$ ,  $p = .019$ ). Furthermore, perceived instructors' involvement is lower for participants involved in PA 3 to 4 times a week compared with participants involved for 2 or less times a week and participants involved for 5 or more times a week ( $F_{(2,434)} = 4.88$ ,  $p = .008$ ). Also, results indicate perceived instructors' involvement differs between classes with 10 participants or less, receiving higher scores than classes with more than 10 participants ( $F_{(2,436)} = 9.83$ ,  $p < .000$ ). Moreover, perceived instructors' involvement is significantly lower in classes with predetermined content than in the other three types of classes ( $F_{(3,435)} = 9.26$ ,  $p < .000$ ). Finally, perceived instructors' involvement is higher in classes led by instructors certified within university programs ( $t_{(437)} = -2.74$ ,  $p = .006$ ) as opposed to instructors that detained private certifications.

**Table 2.** *T-tests and ANOVA for Sociocontextual Variables and Basic Psychological Needs*

	Competence		Relatedness		Autonomy support		Involvement	
	M	SD	M	SD	M	SD	M	SD
<b>Participants' characteristics</b>								
<b>Gender</b>								
<b>Women</b>	4.49	1.61	5.95	0.80	3.56	0.71	3.45	0.70
<b>Men</b>	4.51	1.61	5.88	0.72	3.43	0.57	3.26	0.74
<b>Age</b>								
<b>35 and under</b>	5.14 <sup>a**</sup>	1.58	5.77 <sup>a**</sup>	0.88	3.56	0.61	3.33 <sup>a*</sup>	0.70
<b>36 to 52</b>	4.65 <sup>c**</sup>	1.56	5.93	0.77	3.47	0.82	3.36	0.79
<b>53 to 62</b>	4.28 <sup>b**</sup>	1.58	5.97	0.78	3.56	0.66	3.59 <sup>b*</sup>	0.60
<b>63 and over</b>	3.81 <sup>bd**</sup>	1.44	6.14 <sup>b**</sup>	0.71	3.59	0.70	3.45	0.69
<b>Weekly involvement</b>								
<b>2 times or less</b>	4.06 <sup>a**</sup>	1.51	5.89 <sup>a*</sup>	0.80	3.59	0.66	3.53 <sup>b*</sup>	0.61
<b>3 to 4 times</b>	4.57 <sup>b**</sup>	1.58	5.90 <sup>a*</sup>	0.80	3.48	0.73	3.33 <sup>a*</sup>	0.76
<b>5 times or more</b>	4.93 <sup>b**</sup>	1.69	6.14 <sup>b*</sup>	0.76	3.64	0.70	3.56 <sup>b*</sup>	0.67
<b>Classes' characteristics</b>								
<b>Class size</b>								
<b>10 or less</b>	4.49	1.57	6.00	0.69	3.57	0.64	3.62 <sup>a**</sup>	0.57
<b>11 to 20</b>	4.31	1.64	5.89	0.78	3.45	0.83	3.37 <sup>b**</sup>	0.76
<b>21 or more</b>	4.65	1.62	5.94	0.92	3.62	0.59	3.28 <sup>b**</sup>	0.74
<b>Class type</b>								
<b>Predetermined content</b>	4.61	1.64	5.88	0.83	3.47	0.79	3.17 <sup>a**</sup>	0.84
<b>Inside</b>	4.30	1.65	6.06	0.74	3.61	0.54	3.52 <sup>b**</sup>	0.62
<b>Outside</b>	4.77	1.55	5.94	0.72	3.61	0.49	3.61 <sup>b**</sup>	0.57
<b>Stretching and posture</b>	4.23	1.56	5.93	0.85	3.52	0.84	3.51 <sup>b**</sup>	0.63
<b>Class level of difficulty</b>								
<b>For all</b>	4.36 <sup>a**</sup>	1.62	5.97	0.77	3.51 <sup>a**</sup>	0.75	3.45	0.69
<b>Intermediate/advanced</b>	4.94 <sup>b**</sup>	1.48	5.85	0.90	3.71 <sup>b**</sup>	0.40	3.37	0.77

Instructors' characteristics								
Gender								
Women	4.52 <sup>a*</sup>	1.61	5.94	0.79	3.57	0.68	3.44	0.71
Men	4.01 <sup>b*</sup>	1.57	6.02	0.86	3.35	0.83	3.43	0.66
Experience								
2 years or less	4.38	1.49	6.04	0.75	3.59	0.55	3.46	0.70
3 to 10 years	4.67	1.67	5.92	0.78	3.63 <sup>a*</sup>	0.59	3.37	0.73
11 years or more	4.34	1.63	5.90	0.84	3.42 <sup>b*</sup>	0.87	3.49	0.67
Cetification								
University	4.46	1.60	5.97	0.79	3.59	0.63	3.50 <sup>a**</sup>	0.62
Private	4.50	1.63	5.90	0.81	3.46	0.83	3.31 <sup>b**</sup>	0.83

Note: <sup>a</sup> significantly different of <sup>b</sup>; <sup>c</sup> significantly different of <sup>d</sup>; \*  $p < .05$ ; \*\*  $p < .01$   
M: mean, SD: standard deviation.

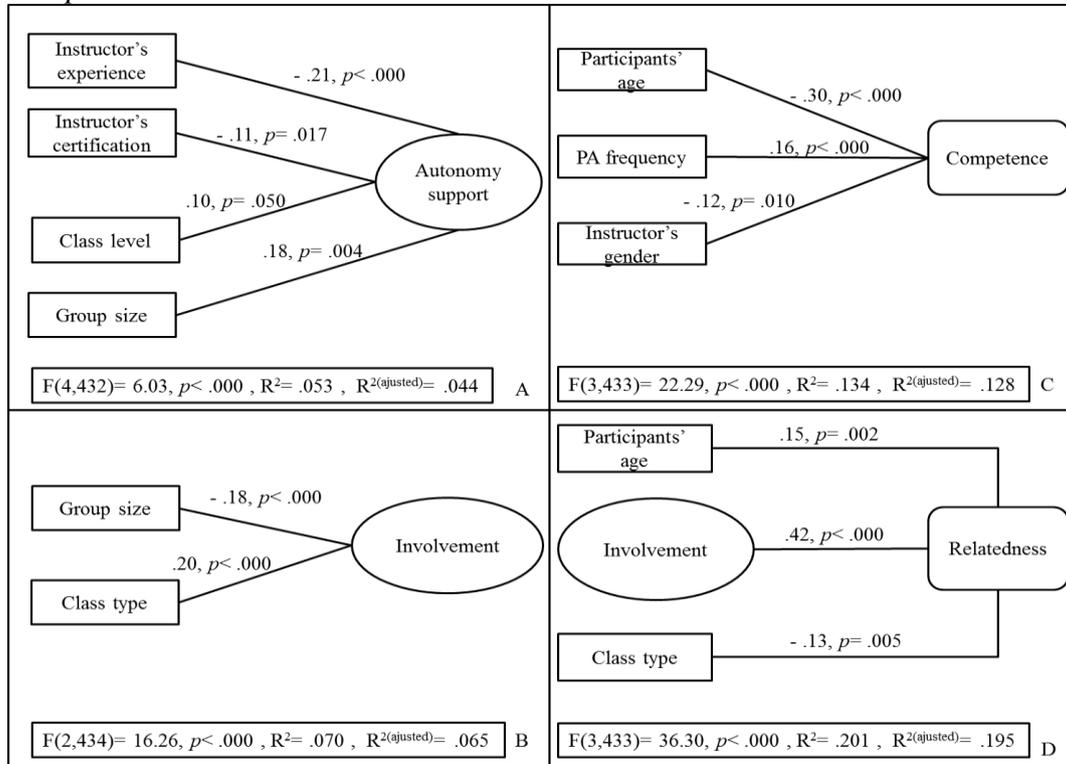
For basic psychological needs satisfaction, no significant differences appeared for participants' gender (competence:  $t_{(444)} = -0.09$ ,  $p = .926$ ; relatedness:  $t_{(444)} = 0.53$ ,  $p = .600$ ), class size (competence:  $F_{(2,449)} = 1.65$ ,  $p = .193$ ; relatedness:  $F_{(2,449)} = 0.65$ ,  $p = .521$ ), class types (competence:  $F_{(3,448)} = 2.74$ ,  $p = .043$ ; relatedness:  $F_{(3,448)} = 1.06$ ,  $p = .365$ ), instructors' years of experience (competence:  $F_{(2,449)} = 2.01$ ,  $p = .135$ ; relatedness:  $F_{(2,449)} = 1.27$ ,  $p = .282$ ) and instructors' certification (competence:  $t_{(450)} = -0.28$ ,  $p = .780$ ; relatedness:  $t_{(450)} = 0.83$ ,  $p = .408$ ). Results show that competence satisfaction gets significantly lower as participants' age increases ( $F_{(3,434)} = 13.83$ ,  $p < .000$ ). Also, competence satisfaction is significantly higher for participants involved in PA 3 times or more per week ( $F_{(2,434)} = 8.46$ ,  $p < .000$ ). Furthermore, participants in classes with level of difficulty "open to all" show significant lower scores of competence satisfaction ( $t_{(450)} = -3.08$ ,  $p = .002$ ) than participants of intermediate-advanced classes. Additionally, participants with male instructors show significant lower scores for competence ( $t_{(450)} = 2.04$ ,  $p = .042$ ) than participants attending classes with female instructors.

Lastly, results show that relatedness satisfaction is significantly higher for participants 63 years of age or older than for participants 35 years of age or younger ( $F_{(3,434)} = 3.80$ ,  $p = .010$ ). Significant results also indicate higher relatedness satisfaction scores for participants involved in PA 5 times or more per week ( $F_{(2,434)} = 3.31$ ,  $p = .037$ ). Relatedness satisfaction shows no significant difference for class characteristics or instructors' characteristics.

For multiple regression results, Figure 1 shows the four models. Model A reports results regarding autonomy support explaining 5.3% of the variance. Model B reports results for perceived instructors' involvement explaining 7.0% of the variance. Model C reports results for competence satisfaction explaining 13.4% of the variance. Finally, Model D reports results for relatedness satisfaction

explaining 20.1% of the variance. This last model includes a strong significant relationship between the perceived instructors' involvement and participants' relatedness satisfaction that could explain the larger effect.

**Figure 1.** Multiple Regression Models for Autonomy Support, Involvement, Competence and Relatedness



## Discussion

The main purpose of this study was to explore the perceived sociocontextual variables and basic psychological needs satisfaction considering multiple participants', instructors' and classes characteristics. Different strategies were used in order to better understand the interactions at stake. Overall, results show that a complex web of relationships surrounds the influence of sociocontextual variables on basic psychological needs. This complexity must be considered for future research on SDT-based interventions or on the motivational process towards PA. The four multiple regression models explained only a small part of the variance for each dependent variable. Despite those results, interesting relationships are observed and provide meaningful insights on group PA context with adults. Furthermore, the results from this study may provide basis for hypothesis to be tested in future projects.

*Basic Psychological Needs Satisfaction*

Notably, findings show that when participants are getting older, their competence satisfaction is lower. This is worrisome because even though the lower scores of competence might be related to the normal aging process, competence satisfaction has been shown to be a strong predictor of self-determined forms of motivation in various age groups (Edmunds et al. 2006, George et al., 2013, Sweet et al. 2012, Markland and Tobin 2010, Vlachopoulos and Karavani 2009). This informs PA professionals that they may need to pay more attention to promoting competence satisfaction when working with older adults. They could do so by giving more information about how the executed exercises transfer in functional everyday activities or by putting the emphasis on the quality of the execution of the movements.

As for relatedness, findings show that as the participants get older, the need for relatedness satisfaction gets higher. More precisely, comparative results indicate that the younger participants (35 and under) have lower relatedness satisfaction than the older group of participants (63 and over). The results regarding age and both psychological needs are overall coherent with studies showing a mediating effect of age on the motivational process (Brunet and Sabiston 2011, Weman-Josefsson et al. 2015). Meanwhile, it is interesting to notice that competence and relatedness are contrastingly influenced by the participants' age. It might be possible that the importance of each need is modulated by age. If so, this means that participants of various ages attend PA for different reasons. This proposed hypothesis needs to be investigated, but is also suggested by Campbell et al. (2001). In future studies, it might be interesting to investigate not only the needs satisfaction but the importance attributed by participants to the satisfaction of each of these needs. In line with the hierarchical model proposed by Vallerand (2000), it seems important to interpret the basic psychological needs satisfaction in consideration of the weight that each need might have at different levels (global, contextual, and situational) and for different individuals.

Furthermore, results indicate that when PA frequency increases, the score of competence is higher. As for relatedness, only comparative results show that participants who exercise five times or more per week have higher relatedness satisfaction. This might indicate that individuals who exercise often feel that their needs are highly satisfied. For the need of competence, this could be explained by frequent exercisers having a more advantageous perception of their physical skills which gives them higher competence satisfaction. Higher relatedness satisfaction is harder to explain without interviewing every participant, but since exercise takes time, one can hypothesize that frequent exercisers might be receiving support from their family, friends and work place to schedule personal time to exercise, which might fulfill the need for relatedness. These results are in line with a study on motivation indicating that individuals with self-determined motivation tend to exercise more frequently (Miquelon et al. 2017). Yet, this might suggest that the motivational process is not linear but multidirectional. Even though PA frequency was a predictor in the present

analysis, it is possible that self-determined motivation for PA increases frequency and, in turn, frequency helps individuals feel higher needs satisfaction which nurtured intrinsic motivation. While SDT seems to propose a more linear model, longitudinal research is needed to study potential snowball effects, such as the relationship between PA frequency, basic psychological needs satisfaction and motivation.

No significant relation has been identified between the classes' levels of difficulty and basic psychological needs. Nonetheless, a significant difference is observed for the need of competence between classes "for all" and intermediate-advanced classes. Similar to PA frequency, it is possible to think that participants in intermediate/advanced classes are more physically "skilled", providing them with higher competence satisfaction. This result is coherent with significant correlations reported by Weman-Josefsson et al. (2015) between basic psychological needs satisfaction and high intensity PA. It is also in line with research showing higher intensity in PA for subjects that demonstrate self-determined motivation (Miquelon et al. 2017). The question of multidirectionality raised with PA frequency could also apply for PA intensity.

No other characteristics are related to competence, but relatedness is negatively influenced by class types. Descriptive results show that participants in PA with predetermined content have a lower score for relatedness even though the difference is not statistically significant. Meanwhile, comparative analysis clearly showed a significant difference indicating a lower perceived instructors' involvement in PA with predetermined content compared to the other three class types. In light of the relationship between perceived involvement and relatedness satisfaction that will be discussed next, this indicates that when the instructors were in charge of the planning, participants perceived more relatedness satisfaction and more involvement than when the class content was prescribed by an outside program. It could be that the structure of predetermined content classes prevents some spontaneous behaviors that could enhance the perceived instructors' involvement and participants' relatedness satisfaction. Do these results partially explain why some PA predetermined programs come and go? It certainly increases participants' satisfaction and motivation when PA professionals leading a class do their own content planning.

On a final note for basic psychological needs, results show that participants' perception on instructors' involvement is a positive predictor of relatedness satisfaction. This is coherent with many previous studies stating that social context is a strong predictor of relatedness (Edmunds et al. 2006, George et al. 2013, Sweet et al. 2012, Markland and Tobin 2010). Nevertheless, the influence of perceived instructors' involvement on relatedness is the only relationship observed between a sociocontextual variable and basic psychological needs. In fact, in this study it is shown that autonomy support is not associated to either competence or relatedness satisfaction. This remains coherent with SDT, since autonomy support is supposed to be associated with the need for autonomy, while structure is supposed, and has been shown, to be linked with competence (Edmunds et al. 2008, Tobin 2003). These last results suggest more research is

needed and, more importantly, reveal a great incentive for studying all three sociocontextual variables on a separate basis.

### *Perceived Sociocontextual Variables*

Now that the relationships between characteristics, perceived sociocontextual variables and basic psychological needs have been discussed, direct relationships also exist between characteristics and perceived sociocontextual variables. Less is known about these relations and they will be explained under a more professional angle.

First, perceived autonomy support is positively influenced by the number of participants in the group. This result indicates that participants perceived more autonomy support in larger groups. No significant result appeared in the comparative analysis even though it's possible to observe a slight increase in perceived autonomy support in larger groups. Maybe, in these groups, various levels of participants are represented and therefore the instructor is obligated to provide more choices and options, which in turn contributes to higher perceived autonomy support. Or it might be that, in larger groups, instructors establish routines that allow people to operate more independently.

For involvement, results revealed that, as the groups get larger, participants perceive less involvement on the instructors' part. This result was expected since instructors in smaller groups probably have more time to devote to each individual. No actual documentation has been found to confirm that result in adult PA. However, research in higher education has demonstrated that in smaller groups, students interact more with the teacher and with each other (Desbiens et al. 2013). It is reasonable to think that the same phenomenon could be present in PA groups. This finding can be explained with the combined effects of two variables: the instructors having more time to interact with each individual and the increased interaction among participants.

The overall results regarding group size lead to an intriguing finding. Indeed, the number of attendees is positively linked to the perceived autonomy support, but negatively to the instructors' involvement. Further research, involving observation measures or interviews, might be necessary to better understand those results. One hypothesis might be that as the group gets larger and the instructors have less time to devote to each individual, he or she puts in place more strategies to better support participants' autonomy. Nonetheless, this finding is a plea in favor of the need to study social context in consideration of the three distinct sociocontextual variables since they do not seem to be influenced in the same manner by some of the classes' characteristics.

Additionally, the results indicate that participants of intermediate/advanced classes perceive more autonomy support. From a professional point of view, it is possible that in front of a more "skilled" group, an instructor feels more at ease to give options, feels more confident to leave some decisions to the participants or is more open to welcome participants' ideas. Overall, regardless of the reasons explaining these relationships, findings regarding group size and class difficulty level are interesting because they underline adapted intervention

behaviors in response to group composition. This also highlights the important ability of PA professionals to know their groups and adapt their plans in response to the participants' characteristics, needs and interests.

In relation to the instructors' characteristics, results indicate a negative relationship between instructors' experience and autonomy support. Comparative results confirm that participants who are attending classes led by more experienced instructors perceive less autonomy support. Do more experienced instructors tend to adopt a more direct style when giving instructions to their participants? Or is it a generation effect since age and experience are highly correlated? No clear answer can be obtained with the present results. Future research could use interviews or observation methods to compare intervention behaviors of instructors from various backgrounds.

Also, in classes given by instructors with private certifications, participants perceived less autonomy support than in classes led by university certified instructors. That result must be interpreted with caution, since no significant difference is observed and because instructors with private certifications are more likely to give classes with predetermined content. This could change interactions during the class as shown by the relation between class type and involvement. In fact, perceived instructors' involvement is significantly higher for university certified instructors even though no significant relationship is observed. Consequently, it might be that instructors with private certifications are less aware of the importance of autonomy support and involvement, an attitude which possibly emerge in their behavior during a class and impact the participants' perceptions.

### *Limitations*

Overall and despite all the significant relationships, the variances explained in the multiple regression models are still small for autonomy support, involvement and competence, and moderate for relatedness. This indicates that more variables may be at stake in this complex motivational process. The elimination of two variables (structure and autonomy), due to psychometric issues, may be one reason which contributes to obtaining smaller explained variances. Also, readers should be careful interpreting results regarding competence since the ratio of items per factor is lower (2:1) than recommended (4:1 to 6:1) (Bourque et al. 2006). It is the main limit of this study and it is a concern in the interpretation of the findings. First, it reflects the lack of adapted instruments in French language in this specific field of research (Lanoue et al. 2017). Second, it prevents the authors to provide a full portrait of basic psychological needs theory of SDT. Still, working with a smaller number, but valid constructs, is the rigorous way to go when exploring variables that have been less studied and could not provide clear hypothesis before. In the future, studies could try to formulate hypotheses based on these findings. Then, they could test these hypotheses using more advanced analyses to prevent type 1 errors. Additionally, it is noteworthy that independent variables have been treated as predictors in this study, but that it is

possible that some of them could interact as co-variables or mediators. Consequently, many different hypotheses are still to be explored.

Other limits of this study include collecting data only once and after the fifth class of a session. This strategy may have resulted in higher scores and created the asymmetric distribution of the data. Still, it is a methodological dilemma because collecting data after the middle of the session had the benefit that participants were better judges of their instructor's behaviors, but created a sample of participants who obviously "liked" the class and the instructor. Therefore, participants who were absent at the time of the data collection were not included in the sample. One cannot exclude that those participants may have left the class because their needs were not satisfied or their perception of their instructor's behaviors was negative. It would be interesting to use a longitudinal design or to work toward obtaining answers from all the participants. This limit and the positively skewed answers from participants also highlight the limit regarding the use of participants' perception in research methodologies. Even though some researchers advocate the use of perceptions, because it is suggested that the perceived behaviors have more impact on needs satisfaction than actual behaviors (Amorose 2007), the combination of perception data and observation data could be useful for a more representative picture of the complexity of instructors' behaviors (Smith et al. 2015).

## Conclusions

In conclusion, the findings are coherent with SDT by subscribing to the idea that a positive relationship between a perceived "supportive social context" and basic psychological needs satisfaction exists. Specifically, this study supports that perceived involvement is associated to relatedness, but could not confirm if autonomy support or structure are related to other basic psychological needs. Incidentally, this study sustains the importance of considering each sociocontextual variable individually to better understand how social context affects basic psychological needs and motivation. The use of three sociocontextual variables, instead of the concept of social context, is an important contribution to the theoretical framework of SDT, as applied to PA. It thus provides operational concepts that are easy to transfer into practice. Furthermore, this study suggests that more variables are at stake in the motivational process such as many personal and environmental characteristics. Future research should pursue analyses that consider the characteristics presented in this study and could broaden the investigated variables through a combination of different social cognitive theories (for example: theory of planned behavior, achievement goal theory or self-regulation theory). Efforts have been made toward that idea, for instance, Hagger and Chatzisarantis (2009) presented an interesting meta-analytic review integrating concepts from SDT and theory of planned behavior. Nonetheless, efforts need to go further to provide a better understanding of the motivational process by examining mediating or moderating effects as well as considering covariables and latent variables.

As for PA professionals, “since SDT is increasingly advocated as a highly applicable and practically useful framework for designing physical activity...” (Silva et al. 2014: 173), they should pursue efforts to create a social context that supports basic psychological needs. Based on this study’s findings, to achieve that goal, professionals are encouraged to keep a limited number of participants per group and to offer specialized classes, as for examples, proposing classes with specific level of difficulty or classes for participants 50 years and older. Also, findings point to the potential positive impact of adapted intervention behaviors in fostering motivational factors. Obviously, smaller groups and specialized classes also help instructors to adapt their behaviors, but most importantly, results showed that it might be easier to foster their participants' motivation if they do their own planning. With that in mind, research on PA intervention with adults must continue in order to uncover the optimal social contexts that could be put in place and all the variables that professionals should consider to foster motivation and perseverance.

## References

- Amorose AJ (2007) Coaching effectiveness. In MS Hagger, NLD Chatzisarantis (eds) *Intrinsic Motivation and Self-Determination Theory in Exercise and Sport*, 209-227. Champaign, IL: Human Kinetics.
- Annesi JJ (2003) Effects of a cognitive behavioral treatment package on exercise attendance and drop out in fitness centers. *European Journal of Sport Sciences* 3(2): 1-16. DOI: 10.1080/17461390300073206.
- Biddle SJH (2007) Exercise motivation across life span. In D Smith, M Bar-Eli (eds) *Essential Readings in Sport and Exercise Psychology*, 378-389. Champaign, IL: Human Kinetics.
- Bourque J, Poulin N, Cleaver AF (2006) Évaluation de l'utilisation et de la présentation des resultants d'analyses factorielles et d'analyses en composantes principales en éducation [Evaluation of the Use and Presentation of Factor Analysis and Principal Component Analysis Results in Education]. *Revue des Sciences de l'Éducation* 32(2): 325-344. DOI: 10.7202/014411ar.
- Bray SR, Millen JA, Eidsness J, Leuzinger C (2005) The effect of the leadership style and exercise program choreography on enjoyment and intention to exercise. *Psychology of Sport and Exercise* 6(4): 415-425. DOI: 10.1016/j.psychsport.2004.07.003.
- Brown TC, Fry MD (2013) Association between females' perceptions of college aerobic class motivational climates and their responses. *Women & Health* 53(8): 843-857. DOI: 10.1080/03630242.2013.835298.
- Brunel P, Vallerand RJ, Chantal Y (2004). Une approche sociocognitive de la motivation en sport. In J La Rue, H Ripoll (eds) *Manuel de Psychologie du Sport 1. Les Déterminants de la Performance Sportive [Sport Psychology Manual: Determinants of Sport Performance]*, 429-474. Paris, France : Édition Revue EP.S.
- Brunet J, Sabiston CM (2011) Exploring motivation for physical activity across the adult lifespan. *Psychology of Sport and Exercise* 12: 99-105. DOI: 10.1016/j.psychsport.2010.09.006.

- Campbell PG, MacAuley D, McCrum E, Evans A (2001) Age differences in the motivating factors for exercise. *Journal of Sport and Exercise Psychology* 23(3): 191-199. DOI: 10.1123/jsep.23.3.191.
- Deci EL, Eghrari H, Patrick BC, Leone DR(1994) Facilitating internalization: the self-determination theory perspective. *Journal of Personality* 62(1): 119-143.
- Deci EL, Ryan RM (1985)*Intrinsic Motivation and Self-Determination in Human Behavior*. New York, NY: Plenum Press.
- Deci EL, Ryan RM (2002) Self-determination research: Reflections and future directions. In EL Deci, RM Ryan (eds) *Handbook of Self-Determination Research*, 431-441. Rochester, NY: University of Rochester Press.
- Deci EL, Ryan RM (2008) Self-Determination Theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*49(3): 182-185. DOI: 10.1037/a0012801.
- Desbiens J-F, Kozanitis A, Lanoue S (2013) Qu'est-ce qui influence la participation verbale en classe d'étudiants en enseignement de l'éducation physique et en kinésiologie? *Revue canadienne d'enseignement supérieur*43(2): 100-131.
- Duda JL, Williams GC, Ntoumanis N, Daley A, Eves FF, Mutrie N, Rouse PC, Lodhia R, Blamey RV, Jolly K(2014)Effects of a standard provision versus an autonomy supportive exercise referral programme on physical activity, quality of life and well-being indicators: a cluster randomised controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*11(10). DOI: 10.1186/1479-5868-11-10.
- Ebben W, Brudzynski L (2008) Motivations and barriers to exercise among college students. *Journal of Exercise Physiology* 11(5): 1-11.
- Edmunds J, Ntoumanis N, Duda JL (2006) A test of Self-determination theory in the exercise domain. *Journal of Applied Social Psychology* 36(9): 2240-2265. DOI: 10.1111/j.0021-9029.2006.00102.x.
- Edmunds J, Ntoumanis N, Duda JL (2008) Testing a self-determination theory-based teaching style intervention in the exercise domain. *European Journal of Social Psychology* 38: 375-388. DOI: 10.1002/ejsp.463.
- Edmunds J, Ntoumanis N, Duda JL (2009) Helping your clients and patients take ownership over their exercise. *ACSM's Health and Fitness Journal* 13(3): 20-25. DOI: 10.1249/FIT.0b013e3181a1c2c4.
- Gagné M, Ryan RM, Bargmann K(2003) Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology* 15(4): 372-390.
- George M, Eys MA, Oddson B, Roy-Charland A, Schinke RJ, Bruner MW (2013) The role of self-determination in the relationship between social support and physical activity intentions. *Journal of Applied Social Psychology* 43: 1333-1341. DOI: 10.1111/jasp.12142.
- Gillet N, Rosnet E (2008) Basic need satisfaction and motivation in sport. *Athletic Insight: The Online Journal of Sport Psychology* 10(3). Retrieved from <http://www.athleticinsight.com/Vol10Iss3/BasicNeed.htm>.
- Gillet N, Rosnet E, Vallerand RJ (2008)Développement d'une échelle de satisfaction des besoins fondamentaux en contexte sportif. *Canadian Journal of Behavioral Science* 40(4): 230-237. DOI: 10.1037/a0013201.
- Gillet N, Vallerand R.J, Paty E, Gobance L, Berjot S (2010) French validation and adaptation of the perceived autonomy support scale for exercise settings to the sport context. *International Journal of Sport and Exercise Psychology* 8(2): 117-128.

- Hagger MS, Chatzisarantis NLD (2009) Integrating the theory of planned behavior and self-determination theory in health behavior: A meta-analysis. *British Journal of Health Psychology* 14(2): 275-302. DOI: 10.1348/135910708X373959.
- Hagger MS, Chatzisarantis NLD, Hein V, Pihu M, Soós I, Karsai I (2007) The perceived autonomy support scale for exercise settings (PASSES): Development, validity, and crosscultural invariance in young people. *Psychology of Sport and Exercise* 8(5):632-653. DOI: 10.1016/j.psychsport.2006.09.001.
- Hannus A, Laev M(2011) Motives and motivating leaders in aerobics classes: exercise motivation and instructors' leadership characteristics. *Acta Kinesiologiae Universitatis Tartuensis*17: 53-65.
- Howell DC (2004) *Méthodes Statistique en Sciences Humaines* [Statistical Methods for Psychology]. Bruxelles, Belgique : DeBoeck.
- Huberty JL, Ransdell LB, Sidman C, Flohr JA, Shultz B, Grosshans O, Durrant L (2008) Explaining long term exercise adherence in woman who complete a structured exercise program. *Research Quarterly for Exercise and Sport* 79(3): 374-384. DOI: 10.1080/02701367.2008.10599501.
- Huddleston H, Fry MD, Brown TC(2012) Corporate fitness members' perceptions of the environment and their Intrinsic Motivation. *Revista de Psicologiadel Deporte* 21(1): 15-23.
- Kinnafick FE, Thogersen-Ntoumani C, Duda JL, Taylor I(2014) Sources of autonomy support, subjective vitality and physical activity behaviour associated with participation in a lunchtime walking intervention for physically inactive adults. *Psychology of Sport and Exercise* 15(2): 190-197. DOI: 10.1016/j.psychsport.2013.10.009.
- Landry JB, Solmon MA(2002) Self-determination theory as an organizing framework to investigate women's physical activity behavior. *QUEST*54: 332-354.
- Lanoue S, Grenon V, Desbiens J-F, Vanderclayen F (2017) Vérification des propriétés psychométriques de l'échelle des besoins psychologiques fondamentaux en sport auprès d'adultes inscrits à des programmes d'activité physique de groupe [Checking the psychometric properties of the Basic Psychological Needs in Sport scale for adults enrolled in group physical activity programs]. *Revue Canadienne des Sciences du Comportement/Canadian Journal of Behavioral Science* 49(4): 251-261. DOI: 10.1037/cbs0000082.
- Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT(2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 380(9838): 219-229. DOI: 10.1016/S0140-6736(12)61031-9.
- Lochbaum M, Jean-Noel J(2016) Perceived autonomy-support instruction and student outcomes in physical education and leisure-time: A meta-Analytic review of correlates. *RICYDE Revista Internacional de Ciencias del Deporte* 43(12): 29-47. DOI: 10.5232/ricyde2016.04302.
- Markland D, Tobin VJ (2010) Need support and behavioral regulation for exercise among exercise referral scheme clients: The mediating role of psychological need satisfaction. *Psychology of Sport and Exercise* 11(2): 91-99. DOI: 10.1016/j.psychsport.2009.07.001.
- McDonough MH, Crocker PRE(2007) Testing self-determined motivation as a mediator of the relationship between psychological needs and affective and behavioral outcomes. *Journal of Sport et Exercise Psychology* 29(5): 645-663.
- McNeil LH, Wyrwich KW, Brownson RC, Clark EM, Kreuter MW(2006) Individual, social environmental, and physical environmental influences on physical activity

- among black and white adults: A structural equation analysis. *Annals of Behavioral Medicine* 31(1): 36-44. DOI: 10.1207/s15324796abm3101\_7.
- Miquelon P, Chamberland P-É, Castonguay A(2017) The contribution of integrated regulation to adults' motivational profiles for physical activity: A self-determination theory perspective. *International Journal of Sport and Exercise Psychology* 15(5): 488-507. DOI: 10.1080/1612197X.2016.1155637.
- Moustaka FC, Vlachopoulos SP, Kabitsis C, Theodorakis Y (2012) Effects of an autonomy-supportive exercise instructing style on exercise motivation, psychological well-being, and exercise attendance in middle-age women. *Journal of Physical Activity and Health* 9(1): 138-150.
- Ommundsen Y, Kvalø SE (2007) Autonomy-mastery: Supportive or performance focused? Different teacher behaviors and pupil's outcomes in physical education. *Scandinavian Journal of Educational Research* 51(4): 386-413. DOI: 10.1080/00313830701485551.
- Panayides P(2013) Coefficient Alpha: Interpret with caution. *Europe's Journal of Psychology* 9(4): 687-696. DOI=: 10.5964/ejop.v9i4.653.
- Puente R, Anshel MH (2010) Exercisers' perceptions of their fitness instructor's interacting style, perceived competence, and autonomy as a function of self-determined regulation to exercise, enjoyment, affect and exercise frequency. *Scandinavian Journal of Psychology* 51(1): 38-45. DOI: 10.1111/j.1467-9450.2009.00723.x.
- Razali NM, Wah YB (2011) Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics* 2(1): 21-33.
- Reinboth M, Duda JL(2006) Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. *Psychology of Sport and Exercise* 7: 269-286. DOI: 10.1016/j.psychsport.2005.06.002.
- Reis HT, Sheldon KM, Gable SL, Roscoe J, Ryan RM(2000) Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin* 26: 419-435.
- Rutten C, Boen F, Seghers J (2012) How school social and physical environments relate to autonomous motivation in physical education: the mediating role of need satisfaction. *Journal of Teaching in Physical Education* 31(3): 216-230. DOI: 10.1123/jtpe.31.3.216.
- Ryan RM, Deci EL (2000) Intrinsic and Extrinsic motivation: classic Definitions and new directions. *Contemporary Education Psychology* 25(1): 54-67. DOI: 10.1006/ceps.1999.1020.
- Ryan RM, Deci EL(2002) Overview of self-determination theory: an organismic dialectical perspective. In EL Deci, RM Ryan (eds) *Handbook of Self-Determination Research*, 3-33. NY, USA: The University of Rochester Press.
- Ryan RM, Deci EL(2007) Active human nature: Self-determination Theory and the promotion and maintenance of sport, exercise, and health. In MS Hagger, NLD Chatzisarantis (eds) *Intrinsic Motivation and Self-Determination Theory in Exercise And Sport*, 1-19. Champaign, IL: Human Kinetics.
- Silva MN, Marques MM, Teixeira PJ(2014) Testing theory in practice: the example of self-determination theory-based intervention. *The European Health Psychologist* 16(5): 171-180.
- Silva M.N, Markland DA, Vieira PN, Coutinho SR, Carraça EV, Palmeira AL, Minderico, CS, Matos MG, Sardinha LB, Teixeira PJ(2010) Helping overweight women become more active: Need support and motivational regulations for

- different forms of physical activity. *Psychology of Sport and Exercise* 11: 591-601. DOI: 10.1016/j.psychsport.2010.06.011.
- Smith N, Tessier D, Tzioumakis Y, Quested E, Appleton P, Sarrazin P, Papaioannou A, Duda JL (2015) Development and validation of the multidimensional motivational climate observation system. *Journal of Sport et Exercise Psychology* 37(1): 4-22. DOI: /10.1123/jsep.2014-0059.
- Statistics Canada (2015a) *Directly Measured physical activity of Canadian adults, 2012 and 2013*. Ottawa, Canada: Statistics Canada. Retrieved from <http://www.statcan.gc.ca/pub/82-625-x/2013001/article/14135-eng.htm>.
- Statistics Canada (2015b) *Physical activity during leisure time, 2014*. Ottawa, Canada: Statistics Canada. Retrieved from <http://www.statcan.gc.ca/pub/82-625-x/201501/article/14189-eng.htm>.
- Sweet SN, Fortier MS, Strachan SM, Blanchard CM (2012) Testing and Integrating self-determination theory and self-efficacy theory in a physical activity context. *Canadian Psychology* 53(4): 319-327. DOI: 10.1037/a0030280.
- Sweet SN, Fortier MS, Strachan SM, Blanchard CM, Boulay P (2014) Testing a longitudinal integrated self-efficacy and self-determination theory model for physical activity post-cardiac rehabilitation. *Health Psychology Research* 2(1): 30-37. DOI: 10.4081/hpr.2014.
- Tabachnick BG, Fidell LS (2007) *Using Multivariate Statistics*. Boston, MA: Pearson Education Inc.
- Teixeira PJ, Carraça EV, Markland D, Silva M, Ryan RM (2012) Exercise, physical activity, and self-determination theory: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity* 9: 78-108. DOI: 10.1186/1479-5868-9-78.
- Tobin VJ (2003) *Facilitating exercise behaviour change: a self-determination theory and motivational interviewing perspective*. Doctoral Thesis. UMI Order Number: UMI Order No. U182884, University of Wales.
- Turner EE, Rejeski WJ, Brawley LR (1997) Psychological benefits of physical activity are influenced by the social environment. *Journal of Sport et Exercise Psychology* 19: 119-130. DOI: 10.1123/jsep.19.2.119.
- Vallerand RJ (1989) Vers une méthodologie de validation trans-culturelle de questionnaires psychologiques: implications pour la recherche en langue française [Towards a cross-cultural validation methodology for psychological questionnaires: implications for French-language research]. *Psychologie Canadienne* 30(4): 662-680.
- Vallerand RJ (2000) Deci and Ryan's Self-determination theory: A view from the hierarchical model of intrinsic and extrinsic motivation. *Psychological Inquiry* 11(4): 312-318.
- Vallerand RJ, Pelletier LG, Koestner R (2008) Reflections on self-determination theory. *Canadian Psychology* 49(3): 257-262. DOI: 10.1037/a0012804.
- Vlachopoulos SP, Karavani E (2009) Psychological needs and subjective vitality in exercise: A cross-gender situational test of the needs universality hypothesis. *Hellenic Journal of Psychology* 6(2): 207-222.
- Weman-Josefsson K, Lindwall M, Ivarsson A (2015) Need satisfaction, motivational regulations and exercise: moderation and mediation effects. *International Journal of Behavioral Nutrition and Physical Activity* 12: 67-78. DOI: 10.1186/s12966-015-0226-0.
- Williams GC, Grow VM, Freedman ZR, Ryan RM, Deci EL (1996) Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology* 70(1): 115-126.

- Wilson PM, Mack DE, Grattan KP (2008) Understanding motivation for exercise: a self-determination theory perspective. *Canadian Psychology* 49(3): 250-256. DOI: 10.1037a0012762.
- Wininger SR (2002) Instructors' and classroom characteristics associated with exercise enjoyment by females. *Perceptual and Motor Skills* 94(2): 395-398.

