

ASSOCIATIONS OF AUTONOMY, COMPETENCE, AND RELATEDNESS WITH ENJOYMENT AND EFFORT IN ELEMENTARY SCHOOL PHYSICAL EDUCATION: THE MEDIATING ROLE OF SELF-DETERMINED MOTIVATION

*Elisavet T. Leptokaridou¹, Symeon P. Vlachopoulos¹, &
Athanasios G. Papaioannou²*

¹Aristotle University of Thessaloniki, Greece

²University of Thessaly, Greece

Abstract: The extent to which self-determined motivation mediates the association of fulfillment of pupils' psychological needs for autonomy, competence, and relatedness with self-reported enjoyment and effort in elementary school Physical Education (PE) was examined. Self-report data were provided by 213 Greek fifth and sixth graders on the aforementioned variables. Using Preacher and Hayes (2008) mediation analysis, it was found that all three needs directly and positively predicted pupils' enjoyment and effort. Indirect effects emerged for autonomy and relatedness in regard to effort but not enjoyment. The findings support to a large extent the validity of self-determination theory motivational dynamics in elementary school PE.

Keywords: Children, physical activity, psychological needs, relative autonomy

Address: Elisavet Leptokaridou, Laboratory of Social Research on Physical Activity, Department of Physical Education and Sport Science at Serres, School of Physical Education and Sport Science, Aristotle University of Thessaloniki, Aghios Ioannis, 62100, Serres, Greece. Tel.: +30 23210 50060. Fax: +30 23210 59125. E-mail: leptokar@gmail.com
Symeon Vlachopoulos, Laboratory of Social Research on Physical Activity, Department of Physical Education and Sport Science at Serres, School of Physical Education and Sport Science, Aristotle University of Thessaloniki, Aghios Ioannis, 62100, Serres, Greece. Tel.: +30 2310 991045. Fax: +30 23210 64806. E-mail: vlachop@phed-sr.auth.gr
Athanasios Papaioannou, Laboratory of Exercise Psychology and Quality of Life, Department of Physical Education and Sport Science, University of Thessaly, Trikala, Karies, Greece. Tel. +30 24310 47012. Fax: +30 24310 47042. E-mail: sakispap@pe.uth.gr

INTRODUCTION

Significant evidence has now supported robust links between physical activity and improved physical and mental health among children and adolescents (Janseen & LeBlanc, 2010). However, children's and adolescents' levels of physical inactivity still remain high in the European region, including Greece (Verloigne et al., 2012; World Health Organization, 2009), putting youngsters' health at risk. School-based physical education (PE) has been viewed as an ideal learning environment to promote physical activity among youth (Cale & Harris, 2013; Cawley, Frisvold, & Meyerhoefer, 2013). However, it has been found that student levels of enjoyment, intrinsic motivation, and positive experiences in PE gradually decline with age. For instance, such a decline has been observed between children in 4th and 6th grades (Prochaska, Sallis, Slymen, & McKenzie, 2003), between children in 5th, 7th and 10th grades (Digelidis & Papaioannou, 1999), and over a period of three years in junior high school students (Ntoumanis, Barkoukis, & Thogersen-Ntoumani, 2009). Therefore, children's motivation for participation in PE should be enhanced in appropriate ways in order to achieve higher levels of physical activity both within and outside PE (Aelterman et al., 2012; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005). Consequently, there is need to better understand factors that may determine students' motivation for participation in PE. Given the significant research attention Self-determination theory (SDT) (Deci & Ryan, 1985; Ryan & Deci, 2002) has received in the PE context (Ntoumanis & Standage, 2009; van den Berghe, Vansteenkiste, Cardon, Kirk, & Haerens, 2014) we examined the dynamics of students' motivation in PE in the context of SDT.

Self-determination theory

A central SDT tenet is that human behavior may be intrinsically motivated, extrinsically motivated or amotivated (Ryan & Deci, 2002). Intrinsically motivated behaviors are engaged in for the inherent interest, enjoyment, and challenges provided by an activity and are fully self-determined; extrinsically motivated behaviors are engaged in to attain an outcome separable from the enjoyment derived from the behavior. Extrinsic motivation has been theoretically subdivided into four different types of regulation (Ryan & Deci, 2002). Externally regulated is the behavior taking place either to avoid punishment or to gain a reward; introjected regulation reflects behavior aiming to attainment of feelings of pride or avoidance of guilt and shame; however, both external regulation and *introjected* regulation represent non self-determined forms of extrinsic motivation. *Identified* regulation is a

more complete form of internalization and reflects behavior that is considered important and valued by the individual; integrated regulation is the most complete form of internalization of extrinsic motivation and results when identifications have been brought into congruence with personally endorsed goals, values, and needs that are already part of the self (Ryan & Deci, 2002). Hence, both identified regulation and *integrated* regulation represent self-determined forms of extrinsic motivation. Additionally, all four types of extrinsic motivation represent a hypothesized continuum of self-determination running from low levels of self-determination (i.e., external regulation) to high levels of self-determination (i.e., integrated regulation). Higher levels of self-determination reflect greater internalization of behavior. *Amotivation* is evident when individuals have no intention and tendency to enact a behavior (Ryan & Deci, 2002).

A fundamental principle of SDT is that internalization of behavior and integration to the self is supported by the fulfillment of three basic psychological needs: *autonomy* (i.e., the need to experience making one's own decisions in the initiation and regulation of one's behavior); *competence* (i.e., the need to feel effective in one's interaction with the environment); and *relatedness* (i.e., the person's need to be emotionally connected to and interpersonally involved with significant others in warm relationships) (Ryan & Deci, 2002). Fulfillment of the three basic needs has been postulated to have direct relationships with indices of psychological well-being (Ryan & Deci, 2002). Moreover, the social environment may facilitate or hinder the fulfillment of these psychological needs. Vallerand (1997) in an attempt to demonstrate the links between SDT variables and motivational consequences proposed that the links can be identified in three different hierarchical levels of generality in measurement, that is, the global level, the contextual level, and the situational level. Vallerand (1997) proposed the Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM). This model posits that the different types of motivational regulation can be influenced by a number of social factors. The influence of these social factors can be exerted through the fulfillment of the three psychological needs. For example, and according to Vallerand (1997), the type of nursing home individuals may live in is a social factor of a global level; the teaching style of an elementary school teacher represents a social factor of a contextual level; and factors such as deadlines or competition in class represent social factors of a situational level. Furthermore, the HMIEM predicts that the different types of motivation may lead to important cognitive, affective, and behavioral consequences. Vallerand (1997) proposed that the motivational sequence can be conceived of as follows: social factors → psychological needs fulfillment → types of motivation → consequences.

Empirical evidence has emerged in support of the motivation mediation model in classroom research using both cross-sectional (Assor, Kaplan, Kanat-Maymon, & Roth, 2005; Black & Deci, 2000; Jang, Reeve, Ryan, & Kim, 2009; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005; Williams & Deci, 1996) and longitudinal designs (Jang, Kim, & Reeve, 2012). Research in PE, both with secondary and high school students, has also revealed that fulfillment of students' psychological needs has been positively associated to global and contextual well-being (Standage, Duda, & Ntoumanis, 2005), as well as other positive outcomes such as enjoyment (Gråstén, Jaakkola, Liukkonen, Watt, & Yli-Piipari, 2012), concentration (Ntoumanis, 2005), effort (Ntoumanis, 2001; Taylor, Ntoumanis, Standage, & Spray, 2010), a preference for challenging tasks (Standage et al., 2005), behavioral persistence (Ntoumanis, 2005), objective indices of achievement/performance (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008), students' intentions to be physically active during leisure-time (Hagger, Culverhouse, Chatzisarantis, & Biddle, 2003; Standage, Duda, & Ntoumanis, 2003) and engagement during PE (Mitchell, Gray, & Inchley, 2014). It has been further shown that intrinsic motivation and identified regulation in PE (e.g., being important to the student to try, improve, and learn in PE) have been consistently associated with adaptive outcomes, such as greater enjoyment in PE, and physical activity levels both within and outside PE (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009; Ullrich-French & Cox, 2009), interest (Goudas, Biddle, & Fox, 1994), self-esteem (Standage & Gillison, 2007), and health-related quality of life (Standage & Gillison, 2007). In contrast, controlled motivation (i.e., external and introjected regulation) and amotivation have been associated with students' boredom and unhappiness (Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008; Ntoumanis, 2001; Standage et al., 2005).

Previous research in PE has mainly focused on investigating secondary school students' and/or college students' determinants of motivational regulations and motivational consequences using SDT. In the elementary PE context, Gonzalez-Cutre et al. (2014) showed in an experimental study that using videos related to physical activity and related discussions with students and parents increased autonomy support of teachers, parents, and peers, and autonomous forms of students' motivation for PE participation. Relatedly, Chen (2014) found strong links between satisfaction of the three psychological needs and self-determined types of regulation which in turn predicted intention for students' physical activity outside school. However, no study to date has examined the relationship between key self-determination variables proposed in Vallerand's (1997) HMIEM such as psychological needs fulfillment, motivational regulations, and outcomes such as enjoyment and effort from a self-determination theory viewpoint in elementary school PE. Given

findings pointing to an age-related decline in levels of positive experiences, intrinsic motivation, and enjoyment in PE settings spanning from elementary school to high school (Digelidis & Papaioannou, 1999; Ntoumanis et al., 2009; Prochaska et al., 2003), the need to better understand the dynamics of motivation for participation in PE in this population becomes even more important.

Therefore, the primary aim of the study was to provide a test of self-determination theory in the context of school PE in a sample of 5th and 6th grade elementary students. The purpose of the study was (a) to examine the direct effects of fulfillment of the needs for autonomy, competence, and relatedness on enjoyment and effort; and (b) to investigate the extent to which such effects may be mediated by self-determined motivation. Put differently, the mechanism proposed by the HMIEM via which psychological needs fulfillment exert their effects on enjoyment and effort via motivational regulations was examined in the present study. The variables of enjoyment and effort represent two of many important motivational outcomes in their own right, but also factors related to the process of physical activity (process factors, e.g., effort expenditure; Marsh, Papaioannou, Martin, & Theodorakis, 2006), and mediators of children's physical activity. Determinants of pupils' enjoyment in school physical education have been examined in a number of studies (Gråstén et al., 2012; Wallhead, Garn, & Vidoni, 2013; Yli-Piipari, Wang, Jaakkola, & Liukkonen, 2012). Effort has also been studied in PE motivational research among middle school students as an important motivational outcome (Lyu & Gill, 2011; Ntoumanis, 2001, 2005); however, effects on enjoyment and effort have not been examined in PE using responses from elementary school students in the context of testing the HMIEM at the domain level. It was hypothesized (a) that the psychological needs fulfillment would be positively associated with enjoyment and effort; and (b) that levels of self-determined motivation for PE participation would mediate the associations of psychological need fulfillment with enjoyment and effort.

METHOD

Participants and Context

Data were collected from 213 students from three primary schools in a town of Northern Greece, corresponding to three different PE teachers. The sample comprised 110 boys (51.6%) and 103 girls (48.4%) aged between 11 and 12 years. Participants were 121 (56.8%) 5th grade students and 92 (43.2%) 6th grade students. Of them, 139 (65.3%) were involved in out-of-school sport activities whereas 74

(34.7%) were not. Those involved were participating in different sports including football, volleyball, handball, basketball, tennis, swimming, and track and field. They participated between 1 and 6 times per week ($M = 3.84$, $SD = 1.32$) and trained between 45 minutes and 180 minutes ($M = 96.54$ minutes, $SD = 30.34$) per training session. The PE teachers were middle aged adults (aged on average 45 years) who possessed at least 15 years of PE teaching experience.

A primary aim of the Greek curriculum for elementary school physical education is the development of motor skills, physical abilities, and, more generally, the promotion of an active lifestyle (Greek Institute for Pedagogy, 2003). Basic skills for soccer, track and field, gymnastics, volleyball, traditional dancing, basketball and handball are taught in PE during a school year. The content of the PE lessons for the particular trimester in which the study was conducted (third trimester of the school year) consisted of teaching basic skills for basketball and handball in line with the national PE curriculum. No differences in teaching methods exist across the school trimesters. The students attending these schools reside in urban and suburban areas around the schools.

Measures

Psychological need fulfillment

To measure the extent to which students' psychological needs for autonomy, competence, and relatedness were fulfilled in PE, the Basic Psychological Needs in Physical Education Scale (BPN-PE; Vlachopoulos, Katartzi, & Kontou, 2011; Vlachopoulos, 2012) was used. The scale comprises 12 items measuring the degree of fulfillment of the three needs using four items per subscale. Sample items include for autonomy (e.g., "I feel that the way PE is taught is the way I would like to"); for competence (e.g., "I feel that I perform correctly even the tasks considered difficult by most of the children"); for relatedness (e.g., "I feel like a valued member of a group of close friends"). Responses were provided on a 7-point Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). Initial evidence supportive of the factor structure (CFI = .97, RMSEA = .04), internal reliability (α values ranging .84 -.89), nomological validity, and item meaning equivalence across boys and girls, and across students who participated or not in out-of-school sports activities has been provided by Vlachopoulos et al. (2011) among Greek elementary school students.

Behavioral regulations for PE participation

To measure behavioral regulations for PE participation, we used the Revised Perceived Locus of Causality in Physical Education scale (PLOC-R; Vlachopoulos,

Katartzi, Kontou, Moustaka, & Goudas, 2011; Vlachopoulos, 2012). The PLOC-R consists of 19 items that measure students' levels of amotivation (e.g., "I don't see why we should have PE"), external regulation (e.g., "Because in this way I will not get a low grade"), introjected regulation in the form of the motive to avoid low contingent self-worth (e.g., "Because I would feel bad about myself if I didn't"), identified regulation (e.g., "Because it is important to me do well in PE"), and intrinsic motivation (e.g., "Because PE is enjoyable"). Responses were provided on a 7-point Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). Evidence in favor of the factor structure (robust CFI = .94, robust RMSEA = .04), simplex structure, internal reliability (α values ranging .69-.81), nomological validity, and item meaning equivalence across boys and girls, and across students who either participated or not in out-of-school sports has also emerged among Greek elementary school students (Vlachopoulos, Katartzi, Kontou, Moustaka, et al., 2011).

Enjoyment

Students' levels of enjoyment in PE were measured via four items used by Scanlan, Simons, Carpenter, Schmidt, and Keeler (1993) to measure sport enjoyment as conceptualized by Scanlan and Simons (1992) in the context of the Sport Commitment Model. The sport-related items "Do you enjoy/are you happy/do you have fun/do you like playing in (program) this season" were adapted to refer to PE. Responses were provided on a 5-point scale using the anchors of 1 (not at all), 2 (a little bit), 3 (sort of), 4 (pretty much) and 5 (very much). A Cronbach's alpha coefficient of .95 has been reported by Scanlan et al. (1993) for this scale in a sample of children aged 10 to 12 years.

The Enjoyment items were translated into Greek using the back-translation procedure. Scale translation followed procedures suggested by Brislin (1986) in which the scale items were translated from English into Greek by a bilingual researcher. Then, the translated instrument was back-translated by academics who were also bilingual. The back-translated versions were then compared with the original English version and any inconsistencies and errors were highlighted before further item wording modifications to reach the final version of the instrument.

Effort

Student-reported effort was measured using four items from the Effort/importance subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) modified for PE. Sample items included "I put a lot of effort in PE" and "I try very hard in PE". Responses were provided on a 7-point Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). Evidence of validity and reliability (α values

of .83, .78, .83, .86) for Greek pupils has been provided in a number of studies (e.g., Digelidis & Papaioannou, 1999; Goudas, Dermitzaki, & Bagiatis, 2000; Marsh et al., 2006) among pupils aged 10-17 years.

Procedure

Study variables were assessed during the middle of the third school trimester. Access to the schools was granted by the Greek Institute for Pedagogy and the principals of the respective schools. Parental and student consent was also secured. Data were obtained on students' gender, participation in out-of-school sports and weekly frequency and duration of such participation, psychological need fulfillment in PE, behavioral regulations for PE participation and self-reported enjoyment and effort in this order. Data collection took place in quiet classroom conditions, not during any PE lesson, without any teacher being present. All of the questionnaires were completed using a student coding system to preserve anonymity and confidentiality. All students were able to read and comprehend the battery of tests as most of the tests have been developed and/or validated with similar samples in the same context. It was pointed out to the students that there are no "right or wrong" answers, and that their responses would not affect their grades. Students were also told that responses will not be disclosed to their PE teacher. Data collection lasted for approximately 30 minutes. Students' responses were provided on questions about PE participation "in general", that is, they did not refer to any specific PE lesson. In this way, the subject matter of the PE lessons was not deemed to have influenced students' responses.

Data analysis

Confirmatory factor analyses. Initially, confirmatory factor analyses (CFA) were performed to examine the factor structure of the instrument scores via EQSWIN 6.1 (Bentler, 2003). Factor variances were fixed at 1.0 and item error covariances were fixed at zero. The goodness of fit indexes used were the chi-square statistic (χ^2), the Comparative Fit Index (CFI: Bentler, 1990), and the Root Mean Square Error of Approximation (RMSEA: Steiger, 1990) accompanied by its 90% confidence interval (90% CI). Given that the χ^2 value is sensitive to sample size (Byrne, 2006), model fit was assessed using the remaining fit indexes and the χ^2 / degrees of freedom ratio. CFI values close to .95 show an excellent fit to the data (Hu & Bentler, 1999) whereas values close to .90 imply an adequate model fit. An RMSEA value smaller than .05 indicates good model fit (Hu & Bentler, 1999) while a value of .08 indicates an adequate fit (Browne & Cudeck, 1993) with .10 being the upper limit (Byrne, 2000).

Cronbach's alpha values (Cronbach, 1951) were computed to examine internal consistency reliability and Pearson's correlations were computed between the subscale mean scores to examine patterns of correlations between the variables.

Mediation. Given that use of multilevel modeling analysis requires a sample of at least 50 units at level two of the analysis (Maas & Hox, 2005) (i.e., level of PE teachers), no such an analysis was presently undertaken due to the very small sample size at level two. Preacher and Hayes' (2008) bootstrapping procedure was used to derive estimates of direct and indirect effects for the mediation models. This procedure involved bootstrapping, which is a non-parametric re-sampling procedure, to estimate the size of the indirect effects using adjusted confidence intervals. The analysis was performed using SPSS 18.0 with Preacher and Hayes' INDIRECT.SPS macro. Here, 95% confidence intervals were used and 1000 bootstrapping resamples were run. Further, the confidence intervals were adjusted for bias.

Relative autonomy index. The relative autonomy index (RAI), or put differently, self-determination index (Vallerand, 1997) was calculated based on behavioral regulation scores by first assigning the weights of -3, -2, and -1 to amotivation, external regulation, and introjected regulation, respectively, and the weights of +1 and +2 to identified regulation and intrinsic motivation, respectively. Then, all of these scores were added to derive the final RAI score (Vallerand, 1997). The weights assigned to the variables reflect their respective placement on the self-determination continuum (Vallerand, 1997). This index reflects the degree of self-determination in behavior and has demonstrated high levels of reliability and validity (Vallerand, 1997). The RAI was used as the mediating variable in the association between each one of the three psychological needs (independent variables) and the outcomes of enjoyment and effort (dependent variables).

RESULTS

Confirmatory factor analyses

Given normalized estimates of Mardia's coefficients for each CFA model greater than 5.0 indicating multivariate nonnormality, the Satorra-Bentler scaled χ^2 statistic was used accompanied by robust fit indexes. Goodness-of-fit indexes for the CFA measurement models indicated, on average, an adequate fit of the models to the data (Table 1). CFI values ranged between .896 and .947.

Table 1. Goodness-of-fit indexes from confirmatory factor analyses of instrument responses.

CFA models	χ^2	Satorra-Bentler Scaled χ^2	<i>df</i>	Robust CFI	Robust RMSEA	Robust RMSEA 90% CI
Basic Psychological Needs in PE						
Correlated 3-factor model	150.92	95.17	51	.947	.064	.044-.084
Revised Perceived Locus of Causality in PE						
Correlated 5-factor model	345.14	287.82	142	.896	.070	.058-.081

Note: χ^2 = chi-square; *df* = degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Squared Error of Approximation; CI = Confidence interval. *N* = 213.

Descriptive statistics and Pearson's correlations

In terms of mean scores of the study variables, students generally reported high levels of needs fulfillment, self-determined regulations, enjoyment, and effort while relatively low levels were observed for amotivation and non self-determined types of motivation (Table 2). The correlation pattern between the variables of interest showed positive inter-correlations between fulfillment of the needs for autonomy, competence and

Table 2. Descriptive statistics for the study variables

Variables	<i>M</i>	<i>SD</i>	α
1. BPN-PE Autonomy	5.35	1.41	.87
2. BPN-PE Competence	5.43	1.32	.90
3. BPN-PE Relatedness	5.83	1.39	.90
4. PLOC-R Amotivation	1.84	1.44	.85
5. PLOC-R External regulation	2.40	1.79	.82
6. PLOC-R Introjected regulation	3.81	1.80	.76
7. PLOC-R Identified regulation	6.08	1.22	.88
8. PLOC-R Intrinsic motivation	6.09	1.19	.86
9. Enjoyment	4.38	0.85	.93
10. Self-reported effort	5.72	1.31	.69

Note: *N* = 213; BPN-PE = Basic Psychological Needs in Physical Education scale. PLOC-R = Revised Perceived Locus of Causality in Physical Education Scale; Responses on BPN-PE are provided on 1-7 scale; for PLOC-R on a 1-7 scale; for enjoyment on a 1-5 scale; for self-reported effort on a 1-7 scale. α = Cronbach's alpha.

Table 3. Pearson's correlations between the study variables

Variables	1	2	3	4	5	6	7	8	9
1. Autonomy	—								
2. Competence	.66**	—							
3. Relatednes	.41**	.46**	—						
4. Amotivation	.02	-.02	-.10	—					
5. External regulation	.06	.12	-.08	.71**	—				
6. Introjected regulation	.21**	.20**	-.03	.40**	.55**	—			
7. Identified regulation	.55**	.52**	.31**	-.02	.06	.31**	—		
8. Intrinsic motivation	.61**	.47**	.31**	-.01	.02	.25**	.78**	—	
9. Self-reported effort	.37**	.41**	.23**	-.19**	-.06	.04	.48**	.41**	—
10. Enjoyment	.56**	.40**	.25**	.03	.05	.15*	.56*	.61**	.29**

Note: $N = 213$. * $p < .05$; ** $p < .01$.

relatedness, self-determined types of motivation, enjoyment, and effort (Table 3). Negative correlations generally emerged of the aforementioned variables with non self-determined types of regulation. The correlations between the behavioral regulations conformed to a simplex-like pattern according to which adjacent variables on the self-determination continuum (Vallerand, 1997) are expected to display positive correlations and stronger than the correlations between variables more distal on the continuum, thus supporting the hypothesized self-determination continuum among the types of behavioral regulations (Table 3).

Differences between pupils participating or not in out-of-school sports

A one-way multivariate analysis of variance was computed to examine whether pupils who participated or not in out-of-school sports differed on any of the variables of the needs for autonomy, competence, relatedness, amotivation, external regulation, introjected regulation, identified regulation, intrinsic motivation, enjoyment, and effort. The results revealed a significant multivariate effect, Hotelling's $T = .09$, $F(10, 199) = 1.95$, $p = .04$, partial eta squared = .08. The univariate tests revealed that significant differences existed for the needs for autonomy and competence with children participating in out-of-school sports reporting higher levels of autonomy fulfillment ($d = .36$) and competence fulfillment ($d = .52$) corresponding to small-to-medium effect sizes for both variables.

Mediation analyses

A series of mediation analyses was computed, each time positing one of the three psychological needs as the independent variable and one of the outcomes as the dependent variable with the RAI always functioning as the mediating variable (Figure 1). The models examined both the direct effect of each psychological need on the dependent variable and at the same time the extent to which the RAI mediated this association. The results of the bootstrapping procedure describing the indirect effects of the three needs on the outcomes are presented in Table 4 while standardized path regression coefficients are presented in Figure 1.

The total effects (i.e., both direct and indirect effects) of the three needs on enjoyment and effort were all significant: for autonomy on enjoyment ($\beta = .56, t = 9.98, SE = .05, p < .001$, variance accounted = 32%); for competence on enjoyment ($\beta = .40, t = 6.93, SE = .06, p < .001$, variance accounted = 17%); for relatedness on enjoyment ($\beta = .25, t = 3.73, SE = .06, p < .001$, variance accounted = 6%); for autonomy on effort ($\beta = .37, t = 5.85, SE = .06, p < .001$, variance accounted = 18%);

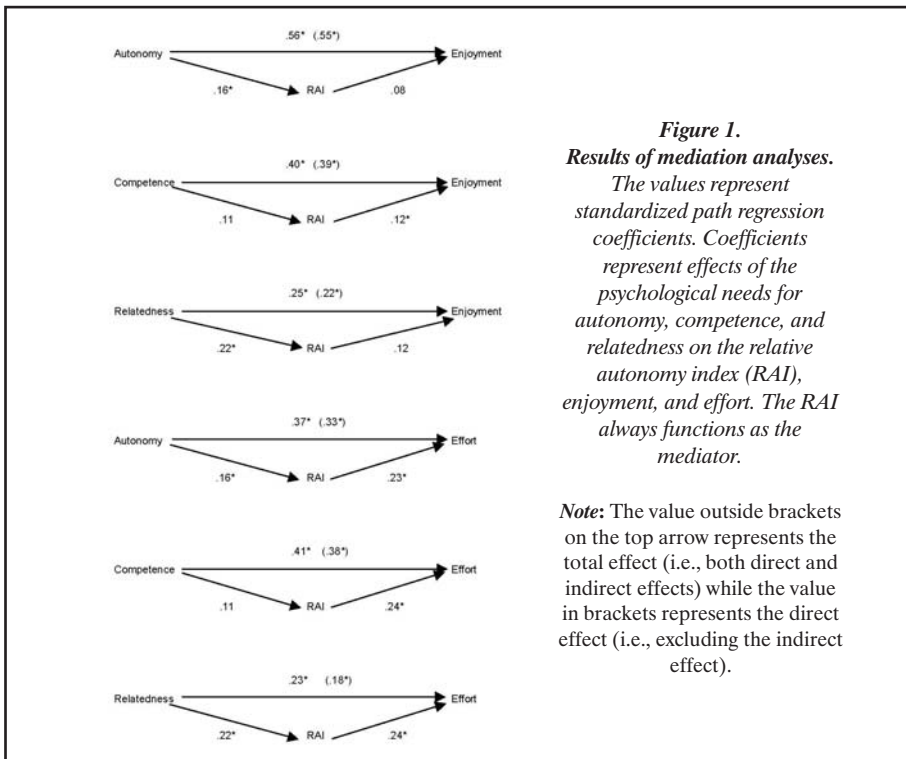


Figure 1.
Results of mediation analyses.

The values represent standardized path regression coefficients. Coefficients represent effects of the psychological needs for autonomy, competence, and relatedness on the relative autonomy index (RAI), enjoyment, and effort. The RAI always functions as the mediator.

Note: The value outside brackets on the top arrow represents the total effect (i.e., both direct and indirect effects) while the value in brackets represents the direct effect (i.e., excluding the indirect effect).

for competence on effort ($\beta = .41, t = 6.55, SE = .06, p < .001$, variance accounted = 22%); for relatedness on effort ($\beta = .23, t = 3.51, SE = .06, p < .001$, variance accounted = 10%).

In terms of direct effects of the psychological needs on the RAI only the needs for autonomy and relatedness significantly affected the RAI (Figure 1) for both the outcomes of enjoyment and effort. Additionally, all direct effects (i.e., excluding the indirect effects) of the three needs on both enjoyment and effort were statistically significant: for autonomy on enjoyment ($\beta = .55, t = 9.63, SE = .05, p < .001$); for competence on enjoyment ($\beta = .39, t = 6.15, SE = .06, p < .001$); for relatedness on enjoyment ($\beta = .22, t = 3.26, SE = .06, p < .01$); for autonomy on effort ($\beta = .33, t = 5.33, SE = .06, p < .001$); for competence on effort ($\beta = .38, t = 6.26, SE = .06, p < .001$); for relatedness on effort ($\beta = .18, t = 2.70, SE = .06, p < .01$). Statistically significant indirect effects via the RAI emerged for autonomy and relatedness in relation to effort (Table 4).

Table 4. Indirect effects of the three psychological needs (IV) on enjoyment and effort (DV) through RAI (M)

	Bootstrap effect		Bias corrected C.I.'s for unstandardized effects	
	Unstandardized	Standardized	Lower	Upper
<i>Enjoyment</i>				
IV1: Autonomy	.008	.013	-.001	.027
IV2: Competence	.009	.015	-.000	.032
IV3: Relatedness	.016	.027	.002	.050
<i>Effort</i>				
IV1: Autonomy	.035*	.038*	.005	.077
IV2: Competence	.028	.028	-.003	.071
IV3: Relatedness	.052*	.055*	.019	.108

Note: IV = independent variable; DV = dependent variable; M = mediator. CI = confidence interval; * $p < .05$.

DISCUSSION

The aim of the study was to provide a test of the motivation mediation model embedded in self-determination theory (Ryan & Deci, 2002; Vallerand, 1997) in the context of elementary school PE. Specifically, the mediating role of self-determined motivation in the form of the relative autonomy index was examined in the associations of the three psychological needs with enjoyment and effort. In regard to the effects of need fulfillment on enjoyment and effort, it was found that all three

needs for autonomy, competence, and relatedness directly affected enjoyment and effort. Additionally, autonomy and relatedness indirectly affected effort but not enjoyment through levels of self-determined motivation (i.e., the relative autonomy index). Generally, fulfillment of the needs for autonomy and competence emerged as predictors stronger than fulfillment of the need for relatedness.

Direct links of psychological needs with enjoyment

According to Ryan and Deci (2002), a motivating force in order to qualify as a need must have a direct relationship to well-being. That is, need satisfaction should promote well-being while need thwarting should lead to negative consequences. Hence, a link is proposed by Ryan and Deci (2002) between need satisfaction and well-being. The present findings demonstrating positive direct links between need fulfillment in PE and levels of enjoyment support Ryan and Deci's (2002) contention and justify not only the direct nature of these links but also their non-negligible magnitude. The finding that the three needs did not have indirect effects on enjoyment through levels of self-determined motivation as was the case with effort underline the postulated direct effect of need fulfillment on markers of well-being. Standage and Gillison (2007) have demonstrated direct links between the need for competence with self-esteem and the need for relatedness with health-related quality of life in a sample of 14-year-old British students in PE while Vlachopoulos et al. (2011) found direct links of autonomy and competence with Greek pupils' subjective vitality in PE. However, direct links have also emerged between all three psychological needs and outcomes of a behavioral nature such as effort in PE (Taylor et al., 2010).

Indirect links of psychological needs with effort

Both direct and indirect links have been found between autonomy and relatedness with effort mediated by levels of self-determined motivation. Vallerand (1997) has distinguished categories of consequences of levels of self-determined motivation such as cognitive (e.g., memory, conceptual learning, concentration, attention), affective (e.g., interest, positive emotions, satisfaction, anxiety) and behavioral consequences (e.g., choice of behavior, persistence at the task, intensity, behavioral intentions). Whereas enjoyment was predicted directly by the psychological needs in line with their nature as determinants of well-being, effort was also predicted indirectly by autonomy and relatedness via self-determined motivation. These findings support Vallerand's (1997) contention about the mediating role of self-

determined motivation in predicting motivational consequences. Indeed, all types of motivation running from amotivation to intrinsic motivation are implicated in the levels of self-determined motivation with higher levels of self-determined motivation assumed to lead to greater positive consequences. Indeed, Taylor et al. (2010) found that both intrinsic motivation and identified regulation were implicated in the prediction of effort in PE, intentions to exercise, and leisure time physical activity.

Links of need fulfillment with self-determined motivation

In terms of the links between psychological needs and self-determined motivation in PE, similar findings have been observed in other studies (Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2006; Zhang, Solmon, Kosma, Carson, & Gu, 2011). For instance, Ntoumanis (2005) showed a positive link between need satisfaction and self-determined motivation which in turn predicted concentration, intention, inversely negative affect, and teacher's ratings of students' effort while Zhang et al. (2011) found that psychological needs affected intrinsic motivation which in turn affected levels of physical activity. Indeed, according to Deci and Ryan (2000) satisfaction of all three needs for autonomy, competence, and relatedness support intrinsic motivation; however, it is the needs for autonomy and competence that are considered essential to intrinsic motivation with the need for relatedness considered to play a more distal role. Deci and Ryan (1985) have maintained that contextual events affect intrinsic motivation and quality of functioning when they influence the degree to which people experience autonomy while partaking in the activity. Hence, providing autonomy support relative to control has been associated with more positive outcomes including intrinsic motivation (Deci & Ryan, 2000). In terms of the need for competence, events that signify effectance may satisfy the need for competence leading to enhancement of intrinsic motivation (Deci & Ryan, 2000). However, for perceived competence to enhance intrinsic motivation, people must also feel responsible for the competent performance (Deci & Ryan, 2000). With regard to relatedness, the theorists argue that there are situations in which relatedness is less central to intrinsic motivation compared to autonomy and competence. This is the case, for instance, when people engage in intrinsically motivated behaviors in isolation such as engaging in an individual activity. Hence, one could argue that given many instances in PE where children attempt to individually master particular tasks, may explain the present findings on the essential role of autonomy and the more distal role of the satisfaction of the need for relatedness in predicting intrinsic motivation. Deci and

Ryan (2000) argued that a secure relational basis appears to be a needed backdrop in the form of distal support to experience intrinsic motivation because generally, a sense of security makes the expression of intrinsic motivation more likely.

In the present study, the fact that levels of self-determined motivation were predicted only by autonomy and relatedness highlights the less central but still important role of relatedness in supporting motivational regulations that may act as mediators of being motivated and performing well in PE (Ntoumanis & Standage, 2009). For instance, León and Núñez (2013) demonstrated the role of the fulfillment of the need for relatedness in predicting various indexes of psychological well-being among students. Also, in explaining the link between the need for relatedness and the relative autonomy index, Ryan, Williams, Patrick, and Deci (2009) argued that in a context of relatedness, persons are more likely to internalize values and skills.

However, the fact that the need for competence did not predict self-determined motivation is antithetical to tenets of the HMIEM. Indeed, the need for competence is assumed to represent a central psychological need in predicting levels of self-determined motivation. However, Deci and Ryan (2000) have maintained that the role of each psychological need may depend on the functional significance of the context. Hence, one might assume that the importance of the needs for autonomy and relatedness in predicting self-determined motivation for this sample and context may override to a certain extent the importance of the need for competence in predicting reasons for participating. Indeed, for all three needs stronger direct effects emerged for both enjoyment and effort compared to indirect effects via self-determined motivation.

Pedagogical practice

The present findings hold implications in terms of pedagogy practice in the context of teaching PE in fifth and sixth grade elementary school students. The overarching message of the present findings is rooted in the support of the SDT mechanism in relation to the effects of psychological need fulfillment on the important motivational outcomes of enjoyment and effort in PE. In terms of practice, the present findings support the use of practices by the PE teacher aiming to fulfill students' psychological needs for autonomy, competence, and relatedness. Autonomy-supportive behaviors include nurturing interest, enjoyment, and a sense of challenge, creating opportunities for initiative, providing choices to the students, providing explanatory rationales highlighting the importance of being involved in the activity, displaying patience to allow students the time they need for self-paced

learning to occur, acknowledging and accepting expressions of negative affect, accepting complaints, and using non controlling language (e.g., “you may want to” as opposed to “you have to”) to minimize feelings of pressure (Jang, Reeve, & Deci, 2010; Ntoumanis & Standage, 2009; Reeve, 2009; Su & Reeve, 2011).

Additionally, providing “structure” may contribute to the fulfillment of the need for competence. Such practices include presenting understandable, clear, and detailed directions, and framing the upcoming lesson well; offering considerable guidance to students’ activities, providing a clear action plan and goals; and offering constructive and informative feedback to enhance students’ sense of gaining control over desired outcomes (Jang et al., 2010). The opposite of structure is experiencing “chaos” and in contexts which are chaotic and uncontrollable, students may experience themselves as incompetent (Skinner & Edge, 2002).

Further, relatedness support (achieved through interpersonal involvement by the PE teacher) involves the expression of genuine and sincere care by the teacher (Reeve, Jang, Carrell, Jeon, & Barch, 2004) rather than being seen as hostile and neglectful. When interpersonal involvement is lacking, students experience themselves as unlovable, and the context as untrustworthy (Tessier, Sarrazin, & Ntoumanis, 2010). Interpersonal involvement behaviors include expressing affection and caring, seeming to enjoy time with students, investing time, attention, and energy, and knowing students’ names (Reeve et al., 2004).

In sum, the aforementioned behaviors seem warranted as elements complementary to the teaching styles used by PE teachers. It also has to be noted that the use of the need-supportive principles does not come in contrast with the content of the PE lessons. Rather, using these principles may enhance the effectiveness of the PE teacher’s teaching approach independent of the subject matter taught. Additionally, research evidence has now emerged demonstrating the potential for such strategies to be taught to PE teachers with effects on modifying their teaching styles, and respective effects on students’ motivation in PE (Tessier et al., 2010).

Limitations and Future Directions

The present findings are limited to 5th and 6th grade Greek elementary students attending PE classes. While the results of the present study provide support to the validity of self-determination theory using responses of elementary students attending PE, the convenience sampling method used limits the representativeness of the findings. Additionally, the single time point design used as well as the reliance on self-reports may limit the generalizability of the findings. The limitations of using paper- and-pencil methods need to be acknowledged. That is, various sources

of individual differences may influence responses to self-report questionnaires such as the tendency to respond in a socially approved manner and the tendency to agree without consideration of the content of the items (Moskowitz, 1986). Evidence of full measurement invariance has also emerged for instruments presently used to measure fulfillment of basic psychological needs (Vlachopoulos et al., 2011) and behavioral regulations for PE participation (Vlachopoulos, Katartzi, Kontou, Moustaka, et al., 2011) across gender, and participation or not in out-of-school sports. These data support the notion that there is equivalence in the interpretation of scale items across important subcategories of pupils, thus, minimizing the influence of individual differences on pupils' responses to a great extent.

Further, students were allowed one teaching hour to complete the questionnaires, despite the fact that data collection was completed in about 30 minutes. In relation to the appropriateness of the tests used, most of the instruments were developed and tested in samples with similar characteristics of the same age range, and thus are considered appropriate in terms of content and age for the samples presently studied (Digelidis & Papaioannou, 1999; Marsh et al., 2006; Vlachopoulos et al., 2011; Vlachopoulos, Katartzi, Kontou, Moustaka, et al., 2011). Additionally, explanations were provided by the researcher if questions arose during the data collection process, thus enhancing children's understanding of test items. Further, the nomological associations presently found between the constructs of interest, that are consistent with theoretical predictions add to the construct validity of the scores obtained. In terms of the effects of lesson content on students' responses, an effort was made to achieve equivalent content across the PE classes in an attempt to negate the effects of lesson content on students' responses.

Given initial evidence supporting the validity of the motivational model proposed by self-determination theory in elementary PE, future research may test the longitudinal dynamics of the associations between changes in key variables in this context or experimentally focus on the effects of need supportive behaviors on outcome variables important from both a motivational and pedagogical viewpoint in this population, as well as the mediators proposed by self-determination theory leading to such outcomes.

Conclusion

The present study provided a test of self-determination theory in a sample of 5th and 6th grade elementary students in PE. Results have supported to a large extent the theoretical mechanism forwarded by self-determination theory to explain pupils' individual differences in motivational outcome variables such as enjoyment

and effort in PE. The findings are supportive of the validity of the motivational dynamics proposed by self-determination theory in this population and context, and support continued research using SDT to study how to effectively intervene to enhance motivation not only for participation in PE but also for broader forms of out-of-school physical activity involvement.

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