

PSYCHOLOGICAL NEEDS AND SUBJECTIVE VITALITY IN EXERCISE: A CROSS-GENDER SITUATIONAL TEST OF THE NEEDS UNIVERSALITY HYPOTHESIS

Symeon P. Vlachopoulos & Eleni Karavani

Aristotle University of Thessaloniki, Greece

Abstract: The present study examined (a) the mediating role of the psychological needs for autonomy, competence, and relatedness in the relationship between perceived autonomy support and levels of subjective vitality among Greek-speaking exercise participants at the situational level of generality; and (b) the validity of the needs universality hypothesis across gender in exercise. Exercise participants ($N = 388$) aged between 18 and 61 years completed scales assessing situational exercise-instructor perceived autonomy support, psychological need satisfaction, and levels of subjective vitality at the end of a single exercise class. Multi-sample latent variable structural equation modeling supported both partial mediation of the psychological needs in the relationship between perceived autonomy support and subjective vitality and the equivalence of the effects of the psychological needs for autonomy, competence, and relatedness on subjective vitality across gender providing support for the needs universality hypothesis. The findings open new research avenues to test the relative effectiveness of various exercise instructing styles on improving indexes of psychological health and well-being and the equivalence of the psychological processes involved across gender.

Key words: Multi-group analysis; Physical activity; Psychological well-being, Self-determination theory.

INTRODUCTION

A large volume of literature supports the improved indexes of psychological well-being (Biddle, Fox, & Boutcher, 2000; Jimenez, Martinez, Miro, & Sanchez, 2008; Morgan, 1997; Netz, Wu, Becker, & Tenenbaum, 2005) associated with regular exercise participation. At the same time, the emphasis placed on the study of quality

Address: Symeon P. Vlachopoulos, Laboratory of Social Research on Physical Activity, Department of Physical Education and Sport Science at Serres, Aghios Ioannis, 621 10 Serres, Greece. Phone: +30-2310-991045. E-mail: vlachop@phed-sr.auth.gr

of life (Rejeski, Brawley, & Schumaker, 1996) makes the need to better understand determinants of psychological well-being and quality of life even more apparent. Subjective vitality has been conceptualized as the psychological experience of possessing enthusiasm and spirit or, put differently, one's conscious experience of possessing energy and aliveness (Ryan & Frederick, 1997). It is also considered an aspect of eudaimonic well-being (Ryan & Deci, 2001) as feeling vital and energetic are characteristics of a fully functioning and psychologically well individual. Owing to its covariation with physical states (e.g., states of illness and fatigue) and psychological factors (e.g., being in love, having a mission, and being effective) feelings of vitality have been said to represent a significant indicator of well-being, content-free of external criteria of well-being such as objective success, health, social supports, and aspirational attainments (Ryan & Frederick, 1997). As a reflection of both organismic and psychological wellness (Cowen, 1994; Diener, 1984; Ryff, 1995) it is expected to be influenced by both psychological and somatic factors (Ryan & Frederick, 1997). That is, somatic factors that drain one's energy and block one's effective functioning are expected to be associated with diminished levels of vitality. In addition, health-related stressors that may threaten one's feelings of autonomy and effectance may negatively influence subjective vitality.

Deci and Ryan (1985, 2002) in their self-determination theory (SDT) have outlined the psychological mechanisms through which the social environment leads to improved psychological well-being. As a theory of personality, motivation, and well-being SDT explains how the social environment affects individuals' levels of well-being. The central concept in the theory is the construct of the basic psychological needs for autonomy, competence, and relatedness. According to Ryan and Deci (2002) and in line with assumptions of the basic needs theory within SDT, a direct link has been proposed between satisfaction of the innate psychological needs and individuals' psychological health. That is, the more the social environment facilitates the fulfillment of the needs for autonomy, competence, and relatedness, the greater the levels of psychological well-being of the individual. Individuals feel autonomous when they experience their behavior as self-endorsed and choiceful. The need for competence is satisfied when individuals feel effective in their transactions with their environment. The need for relatedness is fulfilled when individuals feel authentically related to and that they belong to a given social milieu. Further, and in line with the Hierarchical Model of Intrinsic and Extrinsic Motivation (HMIEM; Vallerand, 1997) these innate needs may act as mediators of the effects of perceptions of autonomy support on psychological consequences and individuals' behavior and this phenomenon may be studied within each of the three levels of generality proposed by the HMIEM. These levels of generality are the global or personality level, the

contextual or domain-specific level (e.g., work, education, exercise) and the situational level (e.g., a single school class, a single exercise class).

In line with SDT theoretical assumptions, and conceptualized in the framework of organismic psychology, higher levels of subjective vitality should be reported by individuals who feel free of conflicts, not externally controlled, and capable in their interactions with their environment or put differently those who experience their selves as the origin of their actions, that is, who feel autonomous (Ryan & Frederick, 1997). Ryan and Frederick (1997) have argued that to the extent that individuals experience their energy as “their own” and emanating from the self (i.e., internal perceived locus of causality) and not “impersonally caused” they will report feelings of vitality. Consequently, they argued that factors that affect people’s potential to act autonomously would be also associated with greater feelings of vitality and this hypothesis has been substantiated in a number of studies (Kasser & Ryan, 1999; Nix, Ryan, Manly, & Deci, 1999; Reinboth & Duda, 2006; Vansteenkiste, Zhou, Lens, & Soenens, 2005).

Kasser and Ryan (1999) demonstrated that among nursing-home residents, levels of subjective vitality were significantly related to perceptions of autonomy support from staff, perceived autonomy, and relatedness. Vansteenkiste et al. (2005) demonstrated that among Chinese students, parental autonomy support was related to feelings of vitality and that these effects were mediated by students’ relative autonomy for studying. Also, changes in subjective vitality among British university athletes were observed over the course of a competitive season and were predicted by changes in the satisfaction of the athletes’ needs for autonomy and relatedness (Reinboth & Duda, 2006). In the exercise domain, Edmunds, Ntoumanis, and Duda (2007) demonstrated that among obese exercise participants levels of vitality were negatively predicted by participants’ introjected regulation, a controlled form of extrinsic motivation where individuals act in order to avoid feelings of guilt or anxiety or to attain ego-enhancement (Ryan & Deci, 2000). Hence, despite that a number of studies have examined these psychological needs as predictors of subjective vitality no study to date has tested such a relationship among exercise participants, and specifically, the mediating role of these needs in the relationship between perceptions of the social environment operationalized through the construct of perceived autonomy support and psychological health as posited by the HMIEM.

Ryan and Deci (2002) have argued that the basic psychological needs are universal and the relationship between need fulfillment and psychological health must apply across ages, genders, and cultures. However, the means through which these needs may be satisfied may vary as a function of age, gender, and culture. Given (a)

the proposed direct link between need satisfaction and psychological health, (b) the proposed mediating role of need satisfaction in the relationship between perceived autonomy support and psychological health (Vallerand, 1997), and (c) the lack of literature testing the needs universality hypothesis across gender in exercise, the purpose of the study was to test the needs universality hypothesis across gender in exercise using subjective vitality as an index of psychological health. It was hypothesized that the psychological needs for autonomy, competence, and relatedness would mediate the influence of perceived autonomy support on subjective vitality and this mediating effect would hold invariant across male and female exercise participants. This hypothesis was tested at the situational level of generality (Vallerand, 1997) based on the participants' experience from a single exercise class.

METHOD

Participants

The sample comprised 388 individuals aged between 18 and 61 ($M = 27.84$, $SD = 8.84$) of which 305 attended private fitness centers and 83 community exercise programs. There were 165 men (42.5%) and 223 women (57.5%). The participants' exercise frequency of attendance ranged between 1 and 8 times per week (Mode = 4, $M = 3.97$, $SD = 1.31$) spending between 15 and 270 minutes ($M = 85.66$, $SD = 36.64$) per visit to the fitness center. Of the total sample, 299 individuals (77.1%) attended group exercise classes whereas 89 (22.9%) were involved in weight training.

Measurement tools

The characteristics of the research tools used in the present study are detailed below while their psychometric properties based on the present data are presented in the Results section.

Situational perceived autonomy support. To examine the extent to which the participants perceived in the particular exercise class their exercise instructor supportive of their autonomy, the 6-item version of the Sport Climate Questionnaire (SCQ; Deci & Ryan, 2007a) was used. It was adapted for the exercise context and the situational level of assessment. The scale was translated into Greek (Moustaka, 2008) using the back-translation procedure (Vallerand, 1989). Autonomy support scores are calculated by averaging the item scores. The term "coach" was substituted by the term "exercise instructor" to make the scale relevant to the context

under study. Sample items include “In today’s class, I felt that my exercise instructor provided me choices and options” and “In today’s class, my exercise instructor encouraged me to ask questions”. Higher average scores represent a higher level of perceived autonomy support. Respondents were asked to indicate the extent to which they agreed with each one of the statements on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Previous research using the Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Ryan, & Deci, 1996) which is the respective climate questionnaire referring to health care providers resulted into a one-factor solution measuring perceived autonomy support and a Cronbach’s alpha of .95.

Situational psychological need satisfaction. The extent to which the psychological needs for autonomy, competence, and relatedness were satisfied at the situational level of generality was reported by the exercise participants through completion of the Basic Psychological Needs in Exercise Scale (BPNES; Vlachopoulos & Michailidou, 2006) modified for the situational level of assessment. The BPNES has been developed based on responses of Greek-speaking exercise participants and comprises 12 items. Following the stem “In today’s class...” participants indicated the extent to which they agreed with the twelve statements (4 items per factor) on a 5-point Likert-type scale ranging from 1 (totally disagree) to 5 (very strongly agree). Sample items for the situational level of assessment are “In today’s class, the exercise program I followed was highly compatible with my choices and interests” (situational autonomy), “In today’s class, I felt I made a huge progress with the end result that I pursue” (situational competence), and “In today’s class, I felt that I was associated with the other exercise participants in a very friendly way” (situational relatedness). Adequate evidence has been provided for the factorial and construct validity of the original scale responses among participants in private fitness centers (Vlachopoulos & Michailidou, 2006; Vlachopoulos & Neikou, 2007), and community exercise programs (Vlachopoulos, 2007) while satisfactory evidence of measurement invariance has also emerged across male and female exercise participants (Vlachopoulos, 2008).

Situational subjective vitality. To determine the participants’ situational levels of subjective vitality, the state level version (Deci & Ryan, 2007b) of the Subjective Vitality Scale (Ryan & Frederick, 1997) was used. Sample items include “At this moment, I feel alive and vital” and “At this time, I have energy and spirit”. Individuals were asked to indicate on this 7-item scale the extent to which each one of the items was true for them on a 7-point Likert-type scale ranging from 1 (not at all true) to 7 (very true). Research by Bostic, Rubio, and Hood (2000) indicated that eliminating item 2 improved the scale’s effectiveness and thus this item was removed

leaving six items to be used. The scale was translated into Greek (Moustaka, 2008) using the back-translation procedure (Vallerand, 1989). Validity information for the scale has been provided by Ryan and Frederick (1997), Nix et al. (1999), and Vansteenkiste et al. (2005) among undergraduate university students and adult participants and by Kasser and Ryan (1999) among nursing-home residents.

Procedure

Verbal consent was obtained from the directors of the fitness centers, whereas each respondent provided informed consent for his/her participation in the study. The questionnaire packet was distributed to the respondents immediately after the end of a single exercise class. The questionnaires took approximately 15 minutes to complete. No significant problems emerged during questionnaire completion. The participants were thanked for participating in the study.

Data analysis

Initially, descriptive statistics, Cronbach's alpha values, and pair-wise Pearson's correlations were computed between the study variables. Then, using structural equation modeling, a series of confirmatory factor analyses were performed on the translated questionnaires to examine their factor structure on the whole sample. Hence, a single-factor model was estimated both for the State Vitality scale and the State Exercise-Instructor Perceived Autonomy-Support scale whereas a 3-factor correlated model was estimated for the situational BPNES responses.

The next step involved estimating the same models of the confirmatory factor analyses within males and females separately before proceeding to test the equivalence of the factor loadings across gender (metric invariance; see Gregorich, 2006). Such a test was considered necessary prior to proceeding to multi-sample structural equation modeling analyses to test the invariance of the structural relationships between the constructs of interest. The aim was to identify the items with invariant factor loadings across gender and to employ only these items as indicators of the constructs of interest in the multi-sample structural equation analyses. Factor loading invariance is a necessary condition for a valid test of the equivalence of latent factor regression coefficients across populations (Gregorich, 2006).

Then, tests of mediation were performed using latent variable structural equation modeling as it is considered the preferred method for such an analysis (Baron & Kenny, 1986; Hoyle & Smith, 1994). This is the case because it can control for measurement error and provide indexes of fit for the entire model (Frazier, Tix, &

Barron, 2004). The aim was to demonstrate that the direct effect of perceived autonomy-support on levels of subjective vitality is reduced when the mediating variables of the psychological needs enter the model. Hence two models were estimated: Model 1 (see Figure 1 in the Results section), which is the “direct effect model” and represents the direct impact of perceived autonomy-support on levels of subjective vitality. Model 2 (see Figure 1 in the Results section), which is the “mediated effect model” that examines the possible change in the direct effect path coefficient of autonomy support on vitality when the three needs are posited as mediators of the relationship. Both of these models were tested in a multi-sample analysis framework to examine the equivalence of the psychological processes involved across gender.

The goodness-of-fit indexes used for model evaluation were the χ^2 statistic, the Non-normed Fit Index (NNFI), the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the accompanying 90% confidence interval (90% CI). The χ^2 evaluates the discrepancy between the observed and the implied covariance matrix with a significant result indicating poor model fit. However, within a large sample this statistic becomes conservative (Byrne, 2006). CFI values less than .90 do not reflect a good model fit (Bentler & Bonett, 1980) whereas values greater than .95 indicate an excellent fit (Hu & Bentler, 1999). A RMSEA value less than .05 indicates a good model fit (Hu & Bentler, 1999) whereas a value of .08 an adequate fit (Browne & Cudeck, 1993) with .10 being the upper limit (Byrne, 2000). Normalized estimate values of multivariate kurtosis greater than 5.0 indicate multivariate non-normality (Byrne, 2006) leading to inspection of the respective goodness of fit indices corrected for non-normality.

RESULTS

Relations between the variables

The internal consistency estimates were greater than .70 for all of the variables. In general, the participants revealed high levels of situational exercise-related autonomy, competence, and relatedness need satisfaction and relatively high levels of subjective vitality and exercise-instructor perceived autonomy support. Pearson's correlations were computed between subjective vitality and perceived autonomy support and exercise-related psychological needs (Table 1). Moderate correlations emerged between the psychological need assessments at the situational level. Autonomy support displayed a moderate correlation with the need for autonomy

Table 1. Internal consistency, descriptive statistics, and Pearson's correlations between psychological needs, autonomy support, and subjective vitality

	α	<i>M</i>	<i>SD</i>	1	2	3	4	5
1. Autonomy	.80	3.82	.76	--				
2. Competence	.80	3.71	.75	.69*	--			
3. Relatedness	.88	3.78	.88	.49*	.55*	--		
4. Autonomy support	.88	5.39	1.11	.42*	.26*	.24*	--	
5. Subjective vitality	.91	4.96	1.36	.36*	.37*	.25*	.41*	--

Note: $N = 388$. * $p < .05$.

and weaker correlations with competence and relatedness assessed at the situational level. Subjective vitality was moderately correlated with autonomy support and the needs for autonomy and competence and more weakly correlated with relatedness.

The measurement model—Whole sample

Initially, confirmatory factor analysis was performed to test the single-factor model reflecting the 6-item state vitality scale and the 6-item state autonomy support scale on the total sample. Factor loadings were free to be estimated while the factor variance was fixed to unity. Item error terms were not allowed to covary. Regarding the vitality scale and given the normalized estimate value of the Mardia's coefficient (> 5.0) the corrected for non-normality goodness-of-fit indexes were consulted. The model had a good fit to the data, Satorra-Bentler scaled $\chi^2(9, N = 388) = 16.22$, NNFI = .988, CFI = .993, RMSEA = .046, 90%CI = .000-.080. Standardized factor loadings ranged from .700 to .882.

With respect to the Autonomy Support scale and given the normalized estimate exceeding 5.0, the corrected goodness-of-fit indexes indicated a good model fit, Satorra-Bentler scaled $\chi^2(9, N = 388) = 29.05$, NNFI = .940, CFI = .964, RMSEA = .076, 90%CI = .046-.107. Standardized factor loadings ranged from .720 to .786.

The three-factor correlated model of the situational BPNES responses also had a good fit to the data. The corrected for non-normality fit indexes were Satorra-Bentler scaled $\chi^2(9, N = 388) = 71.03$, NNFI = .987, CFI = .990, RMSEA = .032, 90%CI = .009-.048. Standardized factor loadings ranged from .562 to .876. The latent factor correlations were .64 for autonomy/competence, .85 for autonomy/relatedness, and .57 for competence/relatedness. No confidence interval of the factor correlations within ± 2 standard errors included 1 supporting the discriminant validity of the factors (Bagozzi, 1981).

The measurement model within men and women

Initially, the single-factor model for the Situational Vitality scale and the Situational Autonomy Support scale were estimated within each gender category. The corrected for non-normality goodness-of-fit indexes indicated a good model fit for situational vitality, that is, for males Satorra-Bentler scaled $\chi^2(9, N = 165) = 9.19$, NNFI = .999, CFI = 1.000, RMSEA = .012, 90%CI = .000-.089, and for females Satorra-Bentler scaled $\chi^2(9, N = 223) = 19.33$, NNFI = .970, CFI = .982, RMSEA = .072, 90%CI = .026-.116. As regards situational autonomy support the indexes also showed a good model fit, that is, for males, Satorra-Bentler scaled $\chi^2(9, N = 165) = 16.73$, NNFI = .956, CFI = .974, RMSEA = .072, 90%CI = .000-.125, and for females, Satorra-Bentler scaled $\chi^2(9, N = 223) = 26.97$, NNFI = .890, CFI = .934, RMSEA = .095, 90%CI = .055-.137. As far as the situational BPNES responses were concerned, the data supported the three-factor model for both genders; for males, Satorra-Bentler scaled $\chi^2(51, N = 165) = 48.09$, NNFI = 1.005, CFI = 1.000, RMSEA = .000, 90%CI = .000-.045, and for females, Satorra-Bentler scaled $\chi^2(51, N = 223) = 103.02$, NNFI = .948, CFI = .959, RMSEA = .068, 90%CI = .049-.086.

Invariance of factor loadings across gender

To examine the extent of invariance of the factor loadings across gender, multi-sample analyses were performed imposing equality constraints on the factor loadings of the scale items. For the situational vitality scale items the metric multi-sample model had a good fit to the data demonstrating metric invariance for all six factor loadings, Satorra-Bentler scaled $\chi^2(24, N = 388) = 34.79$, NNFI = .987, CFI = .990, RMSEA = .034, 90%CI = .000-.057. Regarding the situational autonomy support multi-sample model, a good fit also emerged with the data demonstrating metric invariance for all six item loadings, Satorra-Bentler scaled $\chi^2(24, N = 388) = 52.41$, NNFI = .937, CFI = .950, RMSEA = .055, 90%CI = .035-.076. Regarding the situational BPNES responses the multi-sample model had a good fit to the data, Satorra-Bentler scaled $\chi^2(114, N = 388) = 166.24$, NNFI = .970, CFI = .974, RMSEA = .034, 90%CI = .022-.045. The multi-sample results showed that all item loadings were metrically invariant except Autonomy 3 and Autonomy 4 items that were removed from the following structural equation analyses.

The mediating role of the basic psychological needs

Two multi-sample models were estimated to test the needs universality hypothesis regarding the mediating role of the psychological needs in the relationship between

perceived autonomy support and levels of subjective vitality. That is, an answer was sought to the question “to what extent are the population parameters invariant across gender while testing the tenability of the mediating role of the psychological needs in the autonomy support – subjective vitality relationship?” Two multi-sample structural equation gender invariance models were estimated. Model 1 (see Figure 1), the “direct effect model”, posited autonomy support to directly predict subjective vitality while the factor path coefficients were constrained equal across gender. Model 2 (see Figure 1), the “mediated effect model” posited autonomy support to directly predict the three psychological needs and subjective vitality, and the three needs to directly predict subjective vitality. That is, the psychological needs were posited as mediators of the autonomy support – subjective vitality relationship. Model 2 was also estimated in a gender invariance framework. Both models had a good fit to the data: Model 1, Satorra-Bentler scaled $\chi^2(107, N = 388) = 192.66$, NNFI = .942, CFI = .953, RMSEA = .046, 90%CI = .035-.056; Model 2, Satorra-Bentler scaled $\chi^2(411, N = 388) = 789.79$, NNFI = .891, CFI = .903, RMSEA = .049, 90%CI = .044-.054. Observation of the structural path coefficients revealed

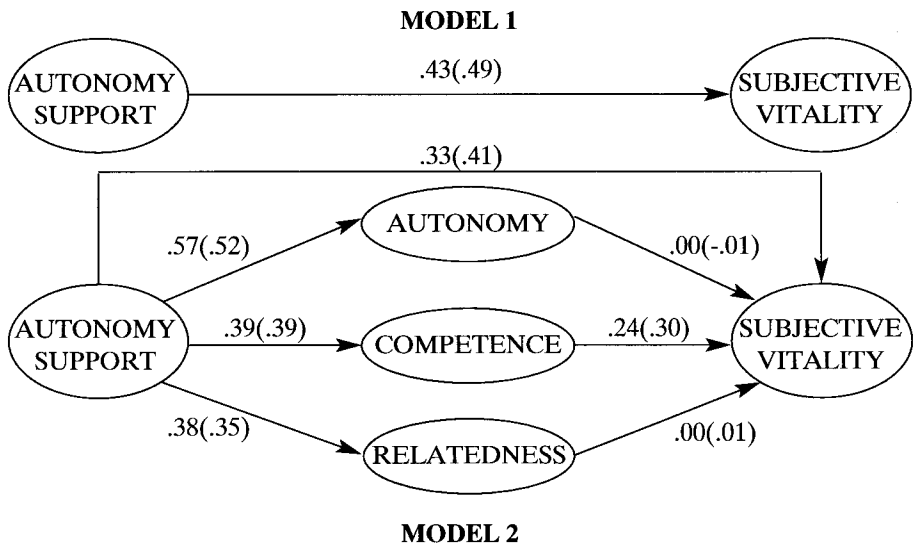


Figure 1. Multi-sample latent variable structural equation models representing a test of the needs universality hypothesis across gender in exercise in the context of the mediating role of the psychological needs in the autonomy support-subjective vitality relationship. Model 1 depicts the "direct effect model"; Model 2 depicts the "mediated effect model".

Note: Structural coefficients within parentheses represent the standardized coefficients derived from the female participants; coefficients outside parentheses represent the standardized coefficients derived from the male participants. The paths from autonomy and relatedness to subjective vitality are statistically non-different from zero ($p > .05$).

that the structural coefficients of the direct autonomy support–subjective vitality path (for males and females) were reduced substantively in Model 2 when the psychological needs entered as mediators of the autonomy support–subjective vitality relationship. These findings demonstrated partial mediation and the significant role of the psychological needs in this relationship. In addition, the demonstrated invariance across all structural path coefficients in both models supported the needs universality hypothesis in exercise as far as gender is concerned.

DISCUSSION

The present study sought to test (a) the mediating role of the needs for autonomy, competence, and relatedness in the relationship between autonomy support and subjective vitality among exercise participants and (b) the validity of the needs universality hypothesis over gender in exercise. As far as the mediating role of the psychological needs is concerned, the results revealed that only the need for competence mediated this relationship partially supporting the hypothesis emanating from Vallerand's (1997) HMIEM at the situational level. The results of this mediation test complement the existing literature on the role of psychological needs as important mediators of the effects of the social environment on the exercise participants' experience with reference to a single exercise class. The results are also in agreement with research testing the effects of particular aspects of the social environment on exercise participants' experience and their respective psychological responses. Specifically, Turner, Rejeski, and Brawley (1997) demonstrated the influence of leadership behavior on feeling state changes following an acute bout of physical activity showing that the participants who received from their exercise instructor much positive feedback and experienced an enriched social atmosphere reported greater increases in revitalization and positive engagement compared to the participants who experienced a professional but bland instructor. Similar results were reported by Fox, Rejeski, and Gauvin (2000) where participants in the socially enriched class both by the exercise instructor and their classmates reported higher enjoyment compared to the participants experiencing the respective conditions as bland. Overall, it seems that the operationalization of the socially enriched environment via the satisfaction of the psychological needs for autonomy, competence, and relatedness, and the experience of perceived autonomy support may open new research avenues to test the relative effectiveness of interventions manipulating the leadership style of the exercise instructor in positively influencing various indexes of psychological health and well-being among exercise participants.

The needs universality hypothesis

In line with Ryan and Deci (2002) and the basic needs theory of SDT, the effects of the satisfaction of the needs for autonomy, competence, and relatedness on various indexes of psychological health and well-being are universal and generalizable across gender, ages, and cultures whereas the means through which such need satisfaction may be achieved may differ across ages, gender, and cultures. The present study tested the generalizability of the effects of need satisfaction on levels of exercise participants' subjective vitality after a single exercise class. It was demonstrated that the effects of need satisfaction on levels of vitality were equivalent across gender. However, the hypothesis was partially supported as it was only the need for competence that significantly mediated the relationship between autonomy support and subjective vitality. The findings are in line with previous research demonstrating that overall need satisfaction was associated with greater positive well-being and less psychological distress in university-based exercise participants and each need contributed to greater positive affect during typical exercise sessions (reported in Wilson & Rodgers, 2007). Further, Vlachopoulos and Michailidou (2006) demonstrated the superior role of the need for competence in predicting outcomes of an affective nature in exercise. Specifically, enjoyment/interest was predicted by both autonomy and to a higher degree by competence among participants in private fitness centers (Vlachopoulos & Michailidou, 2006) whereas all three needs predicted levels of enjoyment/interest among community exercise program participants (Vlachopoulos, 2007) with the needs for autonomy and competence appearing as predictors stronger than the need for relatedness. An explanation for such a finding may lie at the nature of the exercise activity where the physical element is clearly more salient in comparison to other activities (e.g., classroom activities) and predominates.

Future research should test the needs universality hypothesis among exercise participants both in a cross-gender, cross-age, and a cross-cultural fashion including tests of the relative influence of various exercise-instructing styles on psychological health and well-being across either men and women or adults and older individuals or across English-speaking and Greek-speaking exercise participants. The present evidence supporting this hypothesis may facilitate a more systematic assessment of the equivalence of the psychological processes operating during exercise participation across gender, ages, and cultures. Such an assessment will lead to a more detailed understanding of the psychological mechanisms responsible for the enhanced psychological health of exercise participants as well as the particular interventions causing such effects.

Methodological issues

Inextricably linked to the effectiveness of such an assessment are issues of measurement invariance regarding particular psychometric properties of the scale items such as item loadings, item intercepts, and item error variances that should prove equivalent across the populations compared to facilitate valid direct group comparisons (Gregorich, 2006). For instance, in the present analyses, the Autonomy 3 and Autonomy 4 items were not included in the multi-sample structural equation analyses given a lack of equivalence of their meaning across the male and female participants. Given that the equivalence of their meaning is based on the equivalence of their relationship with the factor intended to define across gender (factor loading) and these loadings were not equivalent, including these items in the analyses would induce a threat to the internal validity of such a comparison.

The situational assessment approach used in the present study provided preliminary evidence supportive of the psychometric properties of the instruments used. The findings provided initial support for the validity of the translated state subjective vitality scale, state autonomy support for exercise scale and the Basic Psychological Needs in Exercise Scale modified for situational need assessment. The results of the confirmatory factor analyses and the supported latent correlations with other constructs of interest provided initial support for the continued use of these scales with Greek-speaking exercise participants. Clearly, testing the cross-cultural equivalence of scale responses and theoretical mechanisms in cultures outside the American boundaries is beneficial for gaining knowledge about the applicability of theories and models and such research should be applauded (Byrne, 2001; Sue, 1999). Hence, future research should also focus on the assessment of cross-cultural equivalence of the SDT theoretical mechanisms using responses from English-speaking individuals as a reference point. Clearly, further psychometric work examining the cross-cultural equivalence of responses obtained from the translated scales of vitality, perceived autonomy support, and psychological need satisfaction would be required to facilitate tests of the equivalence of the proposed SDT theoretical mechanisms cross-culturally adding to further tests of the needs universality hypothesis in exercise.

REFERENCES

- Bagozzi, R. P. (1981). An examination of the validity of two models of attitude. *Multivariate Behavioral Research*, 16, 323-359.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Bentler, P. M., & Bonnet, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88, 588-606.
- Biddle, S. J. H., Fox, K. R., & Boutcher, S. H. (2000). *Physical activity and psychological well-being*. Routledge: London.
- Bostic, T. J., Rubio, D. M., & Hood, M. (2000). A validation of the Subjective Vitality Scale using structural equation modeling. *Social Indicators Research*, 52, 313-324.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & S. J. Long (Eds.), *Testing structural equation models* (pp. 445-455). Newbury Park, CA: Sage.
- Byrne, B. M. (2000). *Structural equation modeling with AMOS : Basic concepts, applications, and programming*. Mahwah, NJ: Erlbaum.
- Byrne, B. M. (2001). Measuring self-concept across culture: Issues, caveats, and practice. In R. G. Craven & H. W. Marsh (Eds.), *Self-concept theory, research, and practice: Advances for the new millennium* (pp. 30-41). Sydney, Australia: Self-Concept Enhancement and Learning Facilitation (SELF) Research Centre.
- Byrne, B. M. (2006). *Structural equation modeling with EQS: Basic concepts, application, and programming* (2nd ed.). Mahwah, NJ: Erlbaum.
- Cowen, E. L. (1994). The enhancement of psychological wellness: Challenges and opportunities. *American Journal of Community Psychology*, 22, 149-179.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.
- Deci, E. L., & Ryan, R. M. (Eds.). (2002). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press.
- Deci, E. L., & Ryan, R. M. (2007a). *Perceived autonomy support: The climate questionnaires*. Retrieved July 8, 2007, from http://www.psych.rochester.edu/SDT/measures/auton_sport.html
- Deci, E. L., & Ryan, R. M. (2007b). *Subjective vitality scales*. Retrieved July 8, 2007, from <http://www.psych.rochester.edu/SDT/measures/vital.html>
- Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, 95, 542-575.
- Edmunds, J., Ntoumanis, N., & Duda, J. L. (2007). Adherence and well-being in overweight and obese patients referred to an exercise on prescription scheme: A self-determination theory perspective. *Psychology of Sport and Exercise*, 8, 722-740.
- Fox, L. D., Rejeski, W. A., & Gauvin, L. (2000). Effects of leadership style and group dynamics on enjoyment of physical activity. *American Journal of Health Promotion*, 14, 277-283.
- Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology*, 51, 115-134.

- Gregorich, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Medical Care, 44*, S78-S94.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.
- Hoyle, R. H., & Smith, G. T. (1994). Formulating clinical research hypotheses as structural models: A conceptual overview. *Journal of Consulting and Clinical Psychology, 62*, 429-440.
- Jimenez, M. G., Martinez, P., Miro, E., & Sanchez, A. I. (2008). Psychological well-being and health habits: Are they related to the practice of physical exercise? *International Journal of Clinical and Health Psychology, 8*, 185-202.
- Kasser, V. G., & Ryan, R. M. (1999). The relation of psychological needs for autonomy and relatedness to vitality, well-being, and mortality in a nursing home. *Journal of Applied Social Psychology, 29*, 935-954.
- Morgan, W. P. (Ed.). (1997). *Physical activity and mental health*. Washington, DC: Taylor & Francis.
- Moustaka, F. C. (2008). The influence of an autonomy-supportive intervention on exercise motivation, psychological well-being, and exercise adherence. Manuscript in preparation, Aristotle University of Thessaloniki, Greece.
- Netz, Y., Wu, M., Becker, B. J., & Tenenbaum, G. (2005). Physical activity and psychological well-being in advanced age: A meta-analysis of intervention studies. *Psychology and Aging, 20*, 272-284.
- Nix, G. A., Ryan, R. M., Manly, J. B., & Deci, E. L. (1999). Revitalization through self-regulation: The effects of autonomous and controlled motivation on happiness and vitality. *Journal of Experimental Social Psychology, 35*, 266-284.
- Reinboth, M., & Duda, J. L. (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.
- Rejeski, W. J., Brawley, L. R., & Shumaker, S. A. (1996). Physical activity and health-related quality of life. *Exercise and Sport Sciences Reviews, 24*, 71-108.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*, 68-78.
- Ryan, R. M., & Deci, E. L. (2001). To be happy or to be self-fulfilled: A review of research on hedonic and eudaimonic well-being. In S. Fiske (Ed.), *Annual review of psychology* (Vol. 52, pp. 141-166). Palo Alto, CA: Annual Reviews.
- Ryan, R. M., & Deci, E. L. (2002). An overview of self-determination theory: An organismic-dialectical perspective. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3-33). Rochester, NY: University of Rochester Press.
- Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality, 65*, 529-565.
- Ryff, C. D. (1995). Psychological well-being in adult life. *Current Directions in Psychological Science, 4*, 99-104.

- Sue, S. (1999). Science, ethnicity, and bias: Where have we gone wrong? *American Psychologist*, *54*, 1070-1077.
- Turner, E. E., Rejeski, W. J., & Brawley, L. R. (1997). Psychological benefits of physical activity are influenced by the social environment. *Journal of Sport and Exercise Psychology*, *19*, 119-130.
- Vallerand, R. J. (1989). Vers une methodologie de validation trans-culturelle de questionnaires psychologiques: Implications pour la recherche en langue francaise [Toward a methodology of cross-cultural validation of psychological questionnaires: Implications for research in French]. *Psychologie Canadienne*, *30*, 662-680.
- Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (pp. 271-360). San Diego, CA: Academic.
- Vansteenkiste, M., Zhou, M., Lens, W., & Soenens, B. (2005). Experiences of autonomy and control among Chinese learners: Vitalizing or immobilizing? *Journal of Educational Psychology*, *97*, 468-483.
- Vlachopoulos, S. P. (2007). Psychometric evaluation of the Basic Psychological Needs in Exercise Scale in community exercise programs: A cross-validation approach. *Hellenic Journal of Psychology*, *4*, 52-74.
- Vlachopoulos, S. P. (2008). The Basic Psychological Needs in Exercise Scale: Measurement invariance over gender. *Structural Equation Modeling*, *15*, 114-135.
- Vlachopoulos, S. P., & Michailidou, S. (2006). Development and initial validation of a measure of autonomy, competence, and relatedness in exercise: The Basic Psychological Needs in Exercise Scale. *Measurement in Physical Education and Exercise Science*, *10*, 179-201.
- Vlachopoulos, S. P., & Ncikou, E. (2007). A prospective study of the relationships of autonomy, competence, and relatedness with exercise attendance, adherence, and dropout. *Journal of Sports Medicine and Physical Fitness*, *47*, 475-482.
- Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology*, *70*, 115-126.
- Wilson, P. M., & Rodgers, W. M. (2007). Self-determination theory, exercise, and well-being. In M. S. Hagger & N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 101-112). Champaign, IL: Human Kinetics.