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Causal relationships of sport and exercise involvement with goal orientations, perceived competence and intrinsic motivation in physical education: A longitudinal study

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Abstract

Little information exists about the causal relationships of sport and exercise participation with goal orientations, perceived athletic competence and intrinsic motivation in physical education. A longitudinal study was conducted involving 882 Greek students who completed questionnaires on three occasions: 3 – 5 weeks into the academic year, 3 – 6 weeks before the end of the academic year, and 7 months later. The data were analysed using structural equation models, controlling for age. Task orientation and intrinsic motivation in physical education at the beginning of the academic year predicted sport and exercise participation 7 and 14 months later. Perceived athletic competence both at the beginning and end of the academic year predicted sport and exercise participation 7 and 14 months later, while ego orientation did not predict sport and exercise involvement at either time. Previous sport and exercise participation had positive effects on task orientation and perceived athletic competence 3 – 6 weeks before the end of the academic year and predicted all cognitive-affective constructs 7 months later. These results imply that the cultivation of task orientation, intrinsic motivation in physical education and perceived athletic competence will help to promote sport and exercise participation in adolescence.

Keywords: *adolescents, Greece, perceived ability, task orientation*

Introduction

Regular exercise has many health benefits in adolescence and adulthood (Biddle, Sallis, & Cavill, 1998; Bouchard, Shephard, & Stephens, 1994). A number of intrapersonal, social and environmental variables have been identified as determinants of exercise in children and adolescents (Sallis & Owen, 1998). Several psychological variables have been shown to reduce the likelihood that adolescents will engage in exercise, including low self-efficacy (Reynolds *et al.*, 1990; Trost *et al.*, 1997), perceived barriers such as lack of time and lack of interest (Tappe, Duda, & Ehrnwald, 1989), a dislike of physical education (Zakarian, Hovell, Hofstetter, Sallis, & Keating, 1994) and low enjoyment (Sallis, Prochaska, Taylor, Hill, & Geraci, 1999; Stucky-Ropp & DiLorenzo, 1993).

Perceived athletic competence (Fox & Corbin, 1989), goal orientations (Duda, 2001) and intrinsic motivation (Vallerand & Rousseau, 2001) are considered to be important determinants of achievement behaviours such as persistence in sport. Nevertheless, little research has examined the prospective effects of perceived athletic competence and goal orientations in exercise in adolescence. The association of participation in physical activity with perceived athletic competence and goal orientations is mostly based on cross-sectional data that cannot imply causality (e.g. Fox, Goudas, Biddle, Duda, & Armstrong, 1994). The lack of available research suggesting causality is possibly a cause for the exclusion of goal orientations and perceived athletic competence from epidemiologists' lists of determinants of physical activity in youth (e.g. Sallis & Owen, 1998, p. 129). In addition, not enough studies have examined the causal relationship between out-of-school participation in sport and exercise and intrinsic motivation in physical education (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). The present study examined the causal relationship of sport and exercise participation with

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goal orientations, perceived athletic competence and intrinsic motivation in physical education in a nationally representative sample of Greek adolescents.

All theories of motivation underline the positive role of perceived competence and self-esteem in human motivation (e.g. Bandura, 1986; Deci & Ryan, 1985, Harter, 1978; Weiner, 1985). High perceived competence facilitates positive expectations for success and achievement behaviours such as persistence, choice of challenging tasks and high effort. Research has shown that general self-esteem is unrelated to sport and exercise involvement (Sallis *et al.*, 1992). On the other hand, physical self-esteem is considered an important correlate of engagement in sport and exercise contexts (Fox & Corbin, 1989; Weiss, Bredemeier, & Shewchuk, 1986). Nevertheless, research has yet to establish the causality between physical self-esteem and sport and exercise participation. One should expect that youngsters who participate in sport develop their athletic abilities and this should have positive effects on their perceptions of sport competence (Bandura, 1986). Hence, bi-directional effects should be expected between perceived athletic competence and participation in sport and exercise.

In addition to perceptions of competence, achievement goals are also considered important correlates of achievement behaviours such as participation in sport (Duda, 1989). Nicholls (1984), Dweck (1986) and others (Ames, 1992; Elliot & Church, 1997; Maehr & Nicholls, 1980) developed a theory according to which achievement goals are conceptualized as the purpose (Maehr, 1989) or cognitive focus (Elliot & Church, 1997) of task engagement, and the type of goal adopted is presumed to create a framework of how people interpret, experience and act in achievement settings. Most of this research focused on two types of goals: task orientation (also labelled mastery and learning goals), or the goal of developing one's competence and task mastery, and ego orientation (also called performance or ability goals), or the demonstration of one's competence relevant to others.

It is widely accepted that task orientation is positively linked with adaptive behaviours in physical activity settings (Duda & Hall, 2001; Roberts, 2001), but it is unclear whether there is unanimous agreement about the role of ego orientation. Hardy (1997) suggested that ego orientation facilitates achievement behaviours in elite sport in particular because ego orientation matches the competitive nature of sport. This view is not shared by Duda (1997), who argued that this could only happen when ego orientation is accompanied by high perceived athletic competence. According to achievement goal theorists (Elliott & Dweck, 1988; Nicholls, 1984), high ego-oriented individuals are likely to expect success and positive feelings when they also have high perceptions of ability. On the other hand, when task orientation is high, individuals both high and low in perceived competence sustain positive expectations, experience positive affect and employ adaptive strategies in achievement settings. Indeed, recent reviews (e.g. Duda & Hall, 2001) and meta-analyses (e.g. Ntoumanis & Biddle, 1999) including dozens of studies have supported the positive impact of task orientation on several adaptive values, affects and coping strategies in sport. In turn, these sport-related cognitive-affective patterns are supposed to cultivate youth sport involvement. Duda and Hall (2001, p. 422) also reviewed three studies presented at scientific conferences suggesting causal relationships between goal orientations and athletes' persistence in sport, but they admitted that more work is needed in this area.

Cross-sectional studies in the USA (e.g. Duda, 1989) and Greece (e.g. Papaioannou, 1997b) have indicated positive relationship between participation in sport and goal orientations, but it is still unclear whether this is the cause or effect of youngsters' involvement in sport. According to social learning theory (Bandura, 1986), participation in sport is expected to cultivate youngsters' goals to further improve and demonstrate their sport abilities. Hence, the positive relationship between goal orientations and participation in sport found in cross-sectional studies could be ascribed to social learning effects of sport involvement on goal orientations, rather than the opposite as suggested by achievement goal theory. Robust longitudinal studies examining the causality between goal orientations and physical activity involvement are needed to clarify this issue. In line with achievement goals theory (Elliott & Dweck, 1988; Nicholls, 1984), these studies should also report the interactive effects of ego orientation and perceived competence, which is often omitted in the achievement goal literature. In addition, given the different opinions about the role of ego orientation in sport achievement (Duda, 1997; Hardy, 1997), the interactive effects of task and ego orientation should also be reported. One could hypothesize that the positive effects of task orientation on sport involvement are even stronger when they are accompanied by high ego orientation, but they are undermined when they are joined by low ego orientation (Hardy, 1997), although some authors suggest that ego orientation has no benefit in youth sports (Liukkonen, Telama, & Biddle, 1998).

Enjoyment in physical education is linked with adolescents' sport and exercise participation (Sallis *et al.*, 1999; Stucky-Ropp & DiLorenzo, 1993; Zakarian *et al.*, 1994). Across various theoretical frameworks, enjoyment is considered an important facet of intrinsically motivated behaviours (e.g. Csikszentmihalyi & Nakamura, 1989; Deci & Ryan, 1985; Harter, 1978; Lepper & Greene, 1978; Nicholls, 1989). Vallerand and Rousseau (2001) suggested that intrinsic motivation is related to behaviours performed due to interest and enjoyment. As has been already mentioned, in all theoretical models perceived competence is deemed an important correlate of positive affect and intrinsic motivation. Indeed, studies in physical activity contexts adopting different theoretical frameworks have concluded that perceived athletic competence is an important determinant of intrinsic motivation (e.g. Chatzisarantis, Hagger, Biddle, Smith, & Wank, 2003; Goudas, Biddle, & Fox, 1994; Lintunen, Valkonen, Leskinen, & Biddle, 1999; Papaioannou & Theodorakis, 1996; Vallerand & Reid, 1984; Weiss *et al.*, 1986). In line with achievement goals theory (Nicholls, 1989), some of these studies also revealed that both task orientation and perceived athletic competence determine intrinsic motivation (e.g. Goudas *et al.*, 1994; Lintunen *et al.*, 1999; Papaioannou & Theodorakis, 1996).

Given the promotion of physical activity through school physical education, one would expect the causal effects of intrinsic motivation in physical education on participation in physical activity to be clear. However, there has been little relevant robust research. The positive link between physical activity and intrinsic motivation in physical education, which is typically found in cross-sectional studies (e.g. Sallis *et al.*, 1999), may simply reflect the positive effects of out-of-school sport and exercise involvement on intrinsic motivation in physical education. In this study, we examined the causal relationship of intrinsic motivation in physical education with out-of-school participation in sport and exercise.

We undertook a 14 month longitudinal questionnaire study, conducted in three waves. We constructed structural equation models investigating the causal relationship between participation in sport and exercise and each of the variables pertaining to perceived athletic competence, intrinsic motivation, task and ego orientation, respectively. These analyses show whether each of the cognitive-affective variables is a cause or effect of participation in sport and exercise, irrespective of their relationship with other variables. In these models, the age effects were controlled because task orientation, perceived athletic competence and intrinsic motivation in physical education decline with age (Digelidis & Papaioannou, 1999; Papaioannou, 1997a). Moreover, in line with previous research (Goudas *et al.*, 1994; Lintunen *et al.*, 1999; Papaioannou & Theodorakis, 1996), we examined the effects of perceived competence and task orientation on intrinsic motivation. More specifically, we investigated whether the effects of perceived competence and task orientation on future sport and exercise behaviour are mediated through intrinsic motivation. Hence, a model was developed that included sport and exercise behaviour, goal orientations, perceived competence and intrinsic motivation, which were assessed three times. Finally, we determined whether the interactions between the two goal orientations, between perceived competence and ego orientation, and between perceived competence and task orientation had any impact on future sport and exercise involvement.

Methods

Participants and procedures

An important complication in this study was the requirement in law (by the Greek Ministry of Education) that all questionnaires should be completed anonymously. Hence, for the purposes of the present study, Time 1, Time 2 and Time 3 cases were matched on the basis of class identification, gender and date of birth. Because not all students provided a proper date of birth on all occasions, many cases could not be matched.

At Time 1 (3–5 weeks into the academic year), nine research assistants administered the questionnaires to 4423 students who were in the fifth ($n = 786$, age 11 ± 0.5 years), seventh and eighth ($n = 1864$), and tenth and eleventh ($n = 1773$) grades. At Time 2 (3–6 weeks before the end of the academic year), the same assistants visited the same classes and administered the questionnaires to 4170 students who were present. Based on these reports, 2414 students could successfully be matched for Time 1 and Time 2 responses. It is important to emphasize that many of the students who apparently had only Time 1 or only Time 2 responses actually had both Time 1 and Time 2 responses but could not be matched on the basis of available data. Seven months after Time 2 (i.e. Time 3), the same research assistants administered the questionnaires to 3641 students who were identified by their teachers as having completed the questionnaires at Times 1 and 2. Students' answers to two items assessing whether they had responded to the questionnaire at Time 1 and Time 2 indicated that 326 had responded at Time 1 only, 567 had responded at Time 2 only, and 2501 had responded at both Time 1 and Time 2 (269 did not complete this item). Based on students' reports on class, gender and date of birth, we matched Time 3 records with the matched records of Time 1 and Time 2. We found records of 882 (329 males, 553 females) students who were successfully matched for Time 1, Time 2 and Time 3 responses.

To ensure that the responses of these 882 students did not differ from the responses of the overall cohort of participants, an attrition analysis was conducted. The scores of the 882 students at Time 1, 2 and 3 were compared with the scores of the remaining students at Time 1, 2 and 3, respectively. For all variables shown below, the differences were largely non-significant. Hence, the following analyses are based on the records of 882 students. At Time 3, these students were in the sixth grade (n = 188), eighth grade (n = 189), ninth grade (n = 208), eleventh grade (n = 141) and twelfth grade (n = 156). They were attending 71 randomly selected (i.e. by lottery) schools from those located in nine different geographical areas of Greece, 67% of them in urban (1.5–4.5 million people) and 33% of them in suburban (50,000 to 70,000 people) areas. Of the 882 students, 35.9% were current athletes (i.e. they were trained in a sport club by a coach) and 64.1% were not.

Student consent and permission from the Ministry of Education and the school authorities was obtained.

Measures

Task and Ego Orientation in Physical Education Questionnaire (TEOPEQ). This instrument (Duda & Nicholls, 1992), which is used widely in Greece, has been adapted for physical education classes and has been shown to have very good psychometric properties (e.g. Papaioannou & Macdonald, 1993; Papaioannou & Theodorakis, 1996). Following the stem "I feel most successful in physical education when...", students respond to the seven task-oriented items (e.g. "I learn something that is fun to do") and six ego-oriented items (e.g. "The others can't do as well as me") of the instrument. Students respond to a 5-point Likert scale (5 = *Strongly agree*, 1 = *Strongly disagree*).

Perceived athletic competence. This subscale is part of the five-scale physical self-perception profile developed by Fox and Corbin (1989). It consists of six items (e.g. "Some people feel that they are among the best when it comes to athletic ability") and has been used several times in Greek physical activity settings and exhibits good psychometric properties (e.g. Digelidis % Papaioannou, 1999). In the present study, the one negatively worded item was excluded because it substantially reduced the internal consistency of the subscale. In line with recent research involving this scale (e.g. Biddle, Soos, & Chatzisarantis, 1999; Lintunen *et al.*, 1999), students responded to a 5-point scale (5 = *Very much like me* to 1 = *Not at all like me*).

Intrinsic motivation in physical education. We used the positively worded items of the enjoyment and effort subscales of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989) adapted for Greek physical education (Digelidis & Papaioannou, 1999). Existing research indicates a rather weak factor structure of the IMI and four of its five subscales are considered either to be determinants (i.e. perceived competence and perceived locus of causality) or consequences (i.e. effort, pressure-tension) of intrinsic motivation (Markland & Hardy, 1997; Vallerand & Fortier, 1998). On the other hand, Vallerand and Fortier (1998) underscored that the IMI is a flexible instrument and can be readily modified for almost any type of physical activity. Indeed, several researchers have used the IMI in conjunction with the goal orientation and perceived competence measures employed here (e.g. Duda, Chi, Newton, Walling, & Catley, 1995; Lintunen *et al.*, 1999). In addition, previous research suggests that the Greek versions of the enjoyment and effort subscales had good factor structure and internal consistency (Digelidis & Papaioannou, 1999).

Behaviour. To assess frequency of sport and exercise, the students were asked how many times during the last month they participated in vigorous sport or exercise outside school physical education. "Vigorous" activity was defined as sport/exercise activity that increases substantially people's heart rates, usually to more than 120 beats $\cdot$ min^{-1}. This activity should last an hour or more in one bout of physical activity. It was explained to the students that this happens when they participate in activities such as basketball, football, swimming and aerobics. Their responses were provided on a 6-point scale (*Not at all, 1–5, 5–10, 10–15, 15–20* and *Over 20*). Students were also asked to indicate the average amount of time spent performing sport or exercise on each occasion.

Preliminary confirmatory factor analysis. The current measures are part of a larger investigation and elaborative evidence of their factorial validity is presented elsewhere (H. Marsh, A. Papaioannou, & Y. Theodorakis, unpublished). Briefly, a confirmatory factor analysis was conducted on the larger sample of the matched records of Time 1 and Time 2. This model included the two goal orientation factors, the perceived athletic competence factor, the enjoyment and effort factors, the behaviour factor, age, gender and age × gender, as well as five additional factors irrelevant to the purposes of the current study, assessed at Time 1 and again at Time 2. In total, 25 factors were inferred on the basis of responses to 95 items. A highly restrictive *a priori* model was constructed, in which each indicator was allowed to load only on the *a priori* factor that it was designed to measure. The findings indicated a very good factor structure, as all factor loadings were highly significant and substantial and the goodness of fit was very good in relation to traditional guidelines (e.g. χ^2 = 12298.08, d.f. = 4030, Tucker-Lewis Index = 0.923, root mean square error of approximation = 0.027).

Results

Times 1, 2 and 3: Causal relationship of each cognitive-affective variable with sport and exercise involvement

The analysis of longitudinal data at the three times was made using structural equation modelling. A significant advantage of this analysis is that it allows one to examine the assumption that the errors of measurement associated with one indicator are related to errors of measurement in other indicators. This is particularly important in longitudinal studies in which the same participants complete the same instruments on multiple occasions. According to Joreskog (1979), when responses are given on the same items on multiple occasions, the corresponding residual error variables will tend to be correlated. He also suggested that accurate estimates of relations among constructs could be obtained if correlations among errors are estimated. Hence, correlated uniquenesses were allowed between the same variables at different time points.

Two indicators were used for the latent variable sport and exercise involvement – that is, frequency of sport or exercise and duration per session. This was done because in structural equation modelling it is important to have multiple indicators of each latent variable to model measurement error appropriately. In all measurements, the alpha reliability for the behaviour scale was greater than 0.65. For the latent variables task orientation, ego orientation, intrinsic motivation and perceived athletic competence, the items described in the Methods section were used as indicators. Due to suggestions that enjoyment and effort are not necessarily concomitants, but effort is a consequence of enjoyment and intrinsic motivation (Vallerand & Fortier, 1998), we computed separate models for effort and enjoyment.

Five models were developed to assess the causal effects between sport and exercise involvement and each of the five cognitive-affective constructs (Figures 1–5). Each model included two latent variables measured at Time 1, Time 2 and Time 3. One of these latent variables was always sport and exercise involvement and the second was one of the items assessing task orientation, ego orientation, perceived athletic competence, enjoyment and effort in physical education, respectively. The ordering of pairs was strictly based on the temporal ordering of the variables: all Time 1 variables preceded all Time 2 variables and the latter preceded all Time 3 variables. The latent variables of each pair were assumed to affect the latent variables of the next pair. It was also

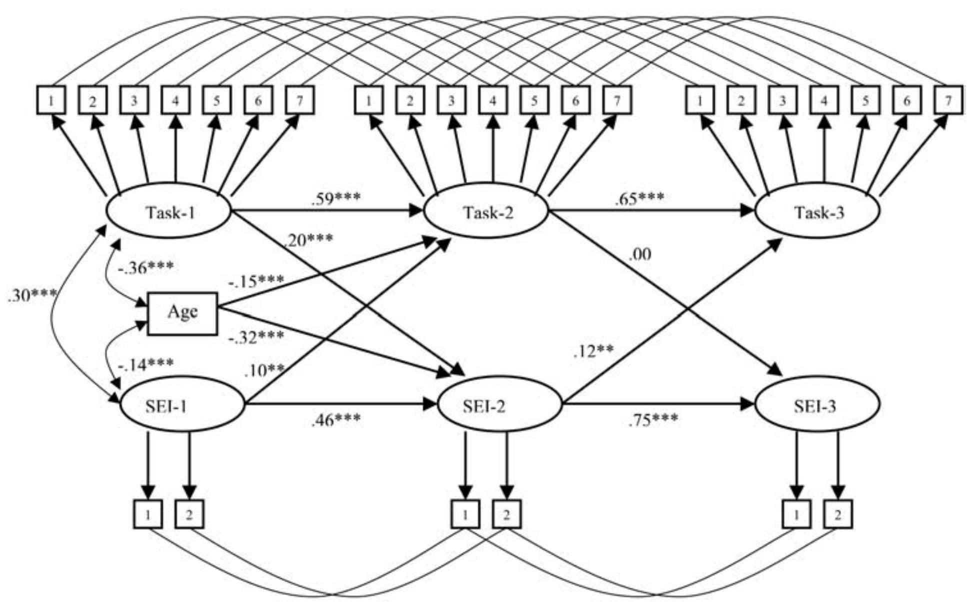

Figure 1. Model 1: Causal paths between task orientation (task) and sport and exercise involvement (SEI). Time 1 (–1), Time 2 (–2) and Time 3 (–3) represent the three data collection points. Task orientation was inferred from seven indicators (i.e. the seven items of the TEOPEQ) and SEI was inferred from two indicators (i.e. frequency of physical activity and hours per session). Straight lines depict standardized beta weights and the curved line between the two latent variables is the correlation. For this model, χ^2 = 958.7, d.f. = 320, TLI = 0.903, CFI = 0.918, RMSEA = 0.048. *** $P < 0.001$, ** $P < 0.01$.

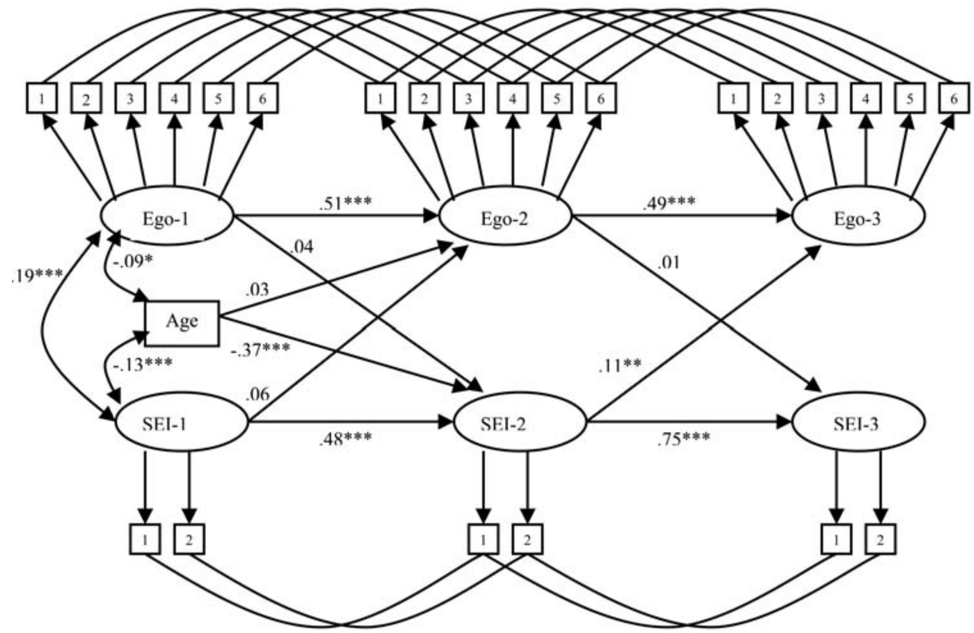

Figure 2. Model 2: Causal paths between ego orientation (ego) and sport and exercise involvement (SEI). Time 1 (−1), Time 2 (−2) and Time 3 (−3) represent the three data collection points. Ego orientation was inferred from six indicators (i.e. the six items of the TEOPEQ) and SEI was inferred from two indicators (i.e. frequency of physical activity and hours per session). Straight lines depict standardized beta weights and the curved line between the two latent variables is the correlation. For this model, χ^2 = 744.4, d.f. = 247, TLI = 0.926, CFI = 0.939, RMSEA = 0.048. *** $P < 0.001$, ** $P < 0.01$.

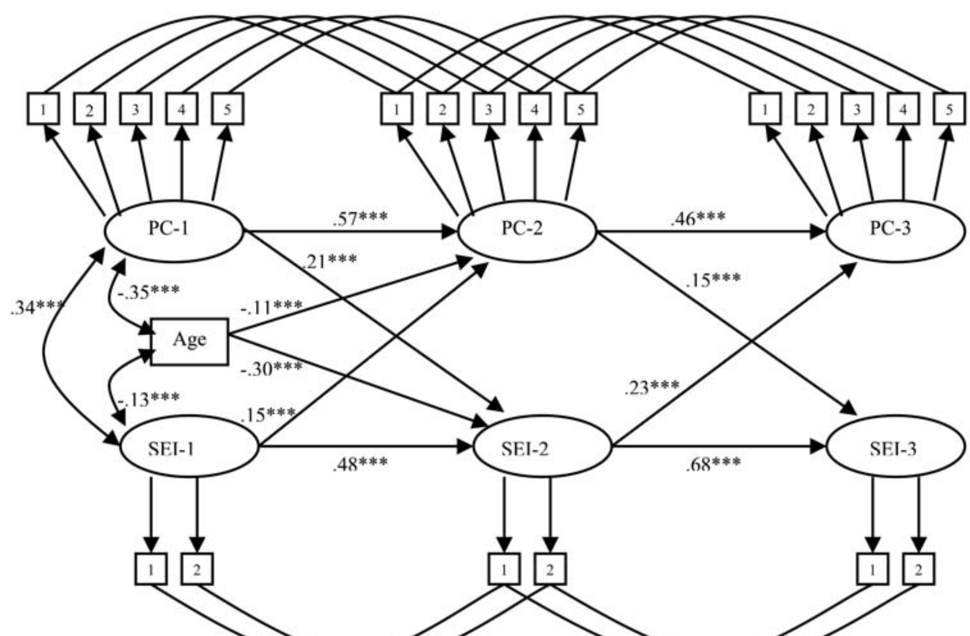

Figure 3. Model 3: Causal paths between perceived athletic competence (PC) and sport and exercise involvement (SEI). Time 1 (−1), Time 2 (−2) and Time 3 (−3) represent the three data collection points. Perceived athletic competence was inferred from five indicators (i.e. the five items of the physical self-perception profile) and SEI was inferred from two indicators (i.e. frequency of physical activity and hours per session). Straight lines depict standardized beta weights and the curved line between the two latent variables is the correlation. For this model, χ^2 = 460.2, d.f. = 183, TLI = 0.944, CFI = 0.955, RMSEA = 0.041. *** $P < 0.001$, ** $P < 0.01$

specified that only latent variables assessed at a prior time had effects on subsequent latent variables. Thus, the latent variables of the same pair were correlated at Time 1 but uncorrelated at Times 2 and 3.

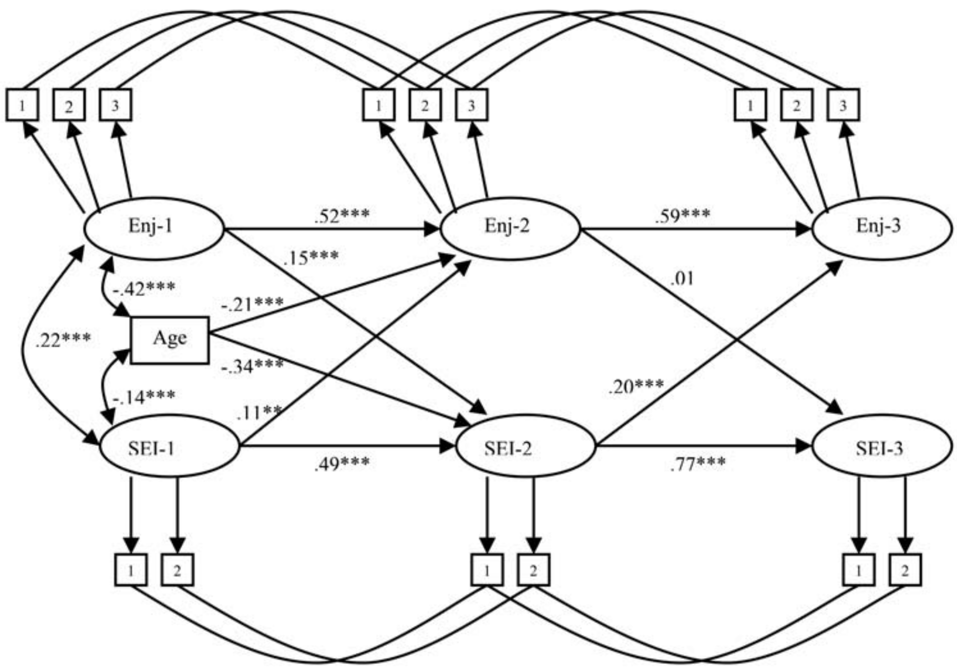

Figure 4. Model 4: Causal paths between enjoyment in physical education (Enj) and sport and exercise involvement (SEI). Time 1 (−1), Time 2 (−2) and Time 3 (−3) represent the three data collection points. Enjoyment was inferred from three indicators (i.e. the three items of the enjoyment in physical education scale) and SEI was inferred from two indicators (i.e. frequency of physical activity and hours per session). Straight lines depict standardized beta weights and the curved line between the two latent variables is the correlation. For this model, χ^2 = 225.3, d.f. = 82, TLI = 0.971, CFI = 0.980, RMSEA = 0.045. *** $P < 0.001$, ** $P < 0.01$.

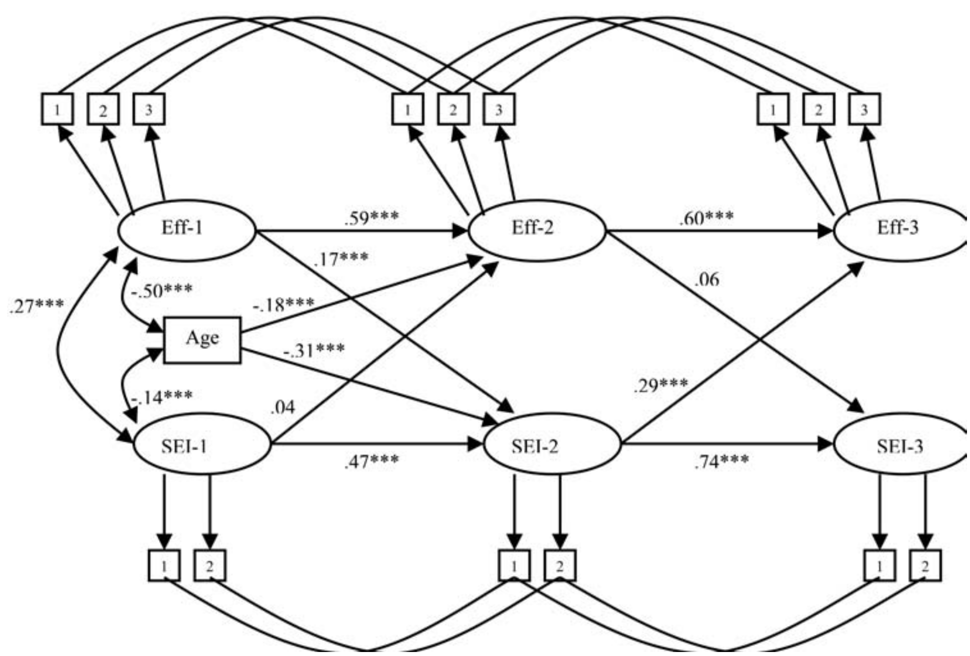

Figure 5. Model 5: Causal paths between effort in physical education (Eff) and sport and exercise involvement (SEI). Time 1 (−1), Time 2 (−2) and Time 3 (−3) represent the three data collection points. Effort was inferred from three indicators (i.e. the three items of the effort in physical education scale) and SEI was inferred from two indicators (i.e. frequency of physical activity and hours per session). Straight lines depict standardized beta weights and the curved line between the two latent variables is the correlation. For this model, χ^2 = 270.0, d.f. = 82, TLI = 0.958, CFI = 0.971, RMSEA = 0.051. *** $P < 0.001$, ** $P < 0.01$.

The purpose of models 1–5 was twofold: (1) to examine the psychometric properties of the present instruments and their stability over time, and (2) to investigate the importance of each cognitive-affective variable for adolescents' sport and exercise involvement irrespective of their relationship with other intrapersonal variables. Moreover, for each model, to control for age differences we added age as a correlate of sport and exercise involvement and the respective cognitive-affective variable at Time 1, and as a predictor of sport and exercise involvement and the respective cognitive-affective variable at Time 2. Of particular interest here is the effect of age on sport and exercise involvement and each cognitive-affective variable at Time 2, controlling for age differences in sport and exercise involvement and each cognitive-affective variable at Time 1. This is an alternative to analysis of covariance, allowing measurement error in the covariates (Arbuckle & Wothke, 1999).

The five models and their goodness-of-fit indices are presented in Figures 1 to 5. Following suggestions by Duncan and Stoolmiller (1993) and Marsh (1989), we allowed the appropriate paired uniquenesses or errors to covary. Taking into consideration the relatively large sample size, the values for χ^2 were expected to be high and, therefore, other indices were also computed. Based on the findings of Marsh and Balla (1994) and Marsh, Balla and Macdonald (1988), the Tucker-Lewis index (TLI) and root mean square error of approximation (RMSEA) were calculated. In addition, the comparative fit index (CFI) (Bentler, 1990) is also provided. The results imply that most models fit the data reasonably well except for model 1, for which the goodness-of-fit indices were relatively low (Hu & Bentler, 1999).

The findings stemming from these structural equation modelling analyses suggested that the latent sport and exercise involvement, task orientation, ego orientation, perceived athletic competence, enjoyment and effort factors were well defined. For example, in the first model, three standardized factor loadings were below 0.50 and none were below 0.38. In the second model, only one standardized factor loading was below 0.50 (0.43); in the third model just one standardized factor loading was below 0.55 (0.43); and in the fourth and fifth models one standardized factor loading was below 0.60 (0.39). All these factor loadings were highly significant.

For each model, the critical paths are the four arrows connecting the cognitive-affective latent variables with the sport and exercise involvement latent variables. These paths are discussed below. In line with predictions, age had a negative relationship with sport and exercise involvement at Time 1, implying that older students participate less in sport and exercise than younger students. Moreover, controlling for age differences in sport and exercise involvement at Time 1, significant differences emerged in sport and exercise involvement at Time 2. Additional analysis showed that while participation in sport and exercise increased significantly for elementary school students from Time 1 to Time 2 ($P = 0.002$, $\eta^2 = 0.10$), for senior high school students sport and exercise involvement decreased significantly from Time 1 to Time 2 ($P = 0.02$, $\eta^2 = 0.02$).

In addition to the four critical paths, the other consistently large paths are stability coefficients – that is, paths connecting the same constructs at different times (Figures 1 – 5). These results are important because they suggest that the present measures remained relatively stable over time. This finding supports the reliability of the measures and adds to the robustness of the present research methodology.

Task orientation and participation in sport and exercise. The path from task orientation at Time 1 to sport and exercise involvement at Time 2 was positive and statistically significant. In other words, task orientation at Time 1 influenced involvement in physical activities 7 months later, beyond the effect of prior involvement in physical activities. Nevertheless, the effect of task orientation at Time 2 on sport and exercise involvement at Time 3 was not significant. Participation in port and exercise had consistently positive effects on subsequent formation of task orientation beyond the effects of prior task orientation. However, it should be noted that the magnitude of these effects was small. Age was negatively related with task orientation at Time 1 and it had a negative effect on task orientation at Time 2.

Ego orientation and participation in sport and exercise. Ego orientation had no effect on subsequent participation in sport and exercise. There is inconclusive evidence that prior involvement in physical activities affects subsequent ego orientation. That is, the path from sport and exercise involvement at Time 2 to subsequent ego orientation was positive and statistically significant, but the path from sport and exercise involvement at Time 1 to ego orientation at Time 2 was not statistically significant. Age had no effect on ego orientation at Time 2.

Perceived athletic competence and participation in sport and exercise. The four critical paths in model 3 provide clear evidence that the causal effects between sport and exercise involvement and perceived athletic competence are reciprocal. That is, all paths from prior perceived athletic competence to subsequent sport and exercise involvement were statistically significant, and all paths from prior sport and exercise involvement to subsequent perceived athletic competence were significant. Age had a negative association with perceived competence at Time 1 and a negative effect on perceived athletic competence at Time 2.

Enjoyment in physical education and participation in sport and exercise. As shown in model 4, prior sport and exercise involvement had significant effects on subsequent enjoyment in physical education lessons at both Times 2 and 3. Enjoyment in physical education at Time 1 had significant effects on sport and exercise involvement at Time 2. On the other hand, enjoyment in physical education lessons at Time 2 had no effects on sport and exercise involvement at Time 3. The negative relationship between age and enjoyment at Time 1, as well as the negative impact of age on enjoyment at Time 2, was noticeable.

Effort in physical education and participation in sport and exercise. At both Times 1 and 2, prior sport and exercise involvement had a positive effect on subsequent effort in physical education. On the other hand, effort in physical education at Time 1 had a positive effect on sport and exercise involvement at Time 2, but effort at Time 2 had no effect on sport and exercise involvement at Time 3. Age had a negative relationship with effort at Time 1 and at Time 2.

Times 1, 2 and 3: The full model

A model was constructed involving all variables measured at all three times. To reduce the number of parameters, the first four task orientation items were combined to form one scale and the remaining three task orientation items were combined to form a second scale (Bandalos & Finney, 2001). These two scales were used as indicators of the latent variable task orientation. Similarly, the first three ego orientation items were combined to form one scale and the remaining three items to form a second scale; these two scales were used as indicators of the ego orientation latent variable. Similarly, the first three perceived athletic ability items were combined to form one scale and the remaining two items to form a second scale; these two scales were used as indicators of the perceived competence latent variable. Given the similar findings in models 4 and 5 and the arguments of McAuley *et al.* (1989) that effort and enjoyment are inherent parts of the intrinsic motivation measure, the effort and enjoyment subscales were used as the two indicators of the intrinsic motivation latent variable.

The structure of the model was based on the temporal assessment of the variables. The four cognitive-affective latent variables at Time 1 and the sport and exercise involvement latent variable at Time 1 were used as exogenous variables. Positive relationships between the exogenous variables were predicted. At Times 2 and 3, all latent variables were considered to be endogenous. It was assumed that all exogenous variables had direct effects on sport and exercise involvement at Time 2. In turn, sport and exercise involvement at Time 2 was assumed to have an effect on all cognitive-affective variables at Time 3. Direct paths were also drawn from all Time 2 cognitive affective variables to sport and exercise involvement at Time 3. In Figure 6, only the statistically significant paths ($P < 0.05$) are shown.

Finally, scale scores for perceived competence and task and ego orientation at Times 1 and 2 were computed and centred. Then, for each of Times 1 – 3, the interaction terms between ego orientation and task orientation, ego orientation and perceived competence, and task orientation and perceived competence were computed. These interaction terms were also included in the model – that is, the interaction terms at Time 1 were considered exogenous variables affecting sport and exercise involvement at Time 2, and the interaction terms at Time 2 were considered endogenous variables affecting sport and exercise involvement at Time 2. Because none of these interactions had any significant impact on participation in sport and exercise, for reasons of simplicity these findings are not reported. Given that ego orientation had no effect on subsequent participation in sport and exercise, ego orientation was excluded from the model shown in Figure 6.

The goodness-of-fit indices for this model suggested a rather good fit of the data. All latent variables were well defined – that is, just one standardized factor loading was below 0.62 (0.45) and all of them were statistically significant ($P < 0.001$).

All stability coefficients were significant ($P < 0.001$) and of moderate value (standardized betas greater than 0.40). Intrinsic motivation at Time 1 had direct effects on sport and exercise involvement at Time 2. The path from task orientation at Time 1 to sport and exercise involvement at Time 2 was not significant. This finding suggests that the effects of task orientation at Time 1 on sport and exercise involvement at Time 2 that emerged previously (i.e. in model 1) were indirect. Perceived competence had direct effects on sport and exercise involvement both at Time 1 and Time 2. Sport and exercise involvement at Time 2 affected task orientation, intrinsic motivation and perceived competence at both Times 1 and 2.

Times 1 and 3: Causal relationship of each cognitive-affective variable with participation in sport and exercise

Intrigued by the non-significant influence of task orientation, enjoyment and effort at Time 2 on sport and exercise involvement at Time 3, we examined whether task orientation and intrinsic motivation at Time 1 had significant effects on sport and exercise involvement at Time 3. That is, we constructed similar models to those shown in Figures 1 – 5, but

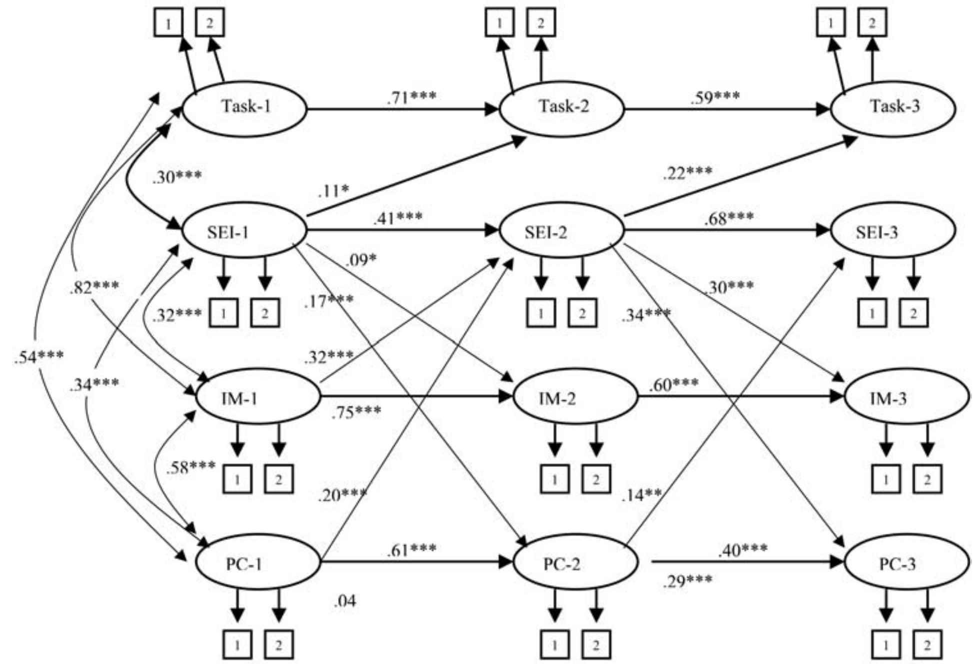

Figure 6. The full model. Latent variables are enclosed by ovals; observed variables are shown in squares, or orthogonal parallelograms; errors appear in small circles. Straight lines depict statistically significant ($P < 0.05$) standardized beta weights and curved lines arecorrelations. For clarity, covariances among error terms and non-significant paths are not shown. SEI = sport and exercise involvement, PC = perceived competence, IM = intrinsic motivation. Time 1 (−1), Time 2 (−2) and Time 3 (−3) represent the three data collection points. For this model, $\chi^2 = 704.0$, d.f. = 205, TLI = 0.932, CFI = 0.949, RMSEA = 0.053. *** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$.

now we excluded all Time 2 variables. In addition, we controlled for age effects as we did in models 1–5. The results are shown in Table I.

It is important to observe that the stability coefficients (autocorrelations) between the Time 1 and Time 3 measures remained relatively robust – that is, all of them were statistically significant and of moderate value except ego orientation, which was relatively low (beta = 0.33, $P < 0.001$). Most important though are the significant effects of task orientation, enjoyment and effort at Time 1 on participation in sport and exercise at Time 3. These effects were weaker than the effects of Time 1 on Time 2 variables, but this is natural given the longer temporal difference between the measurements. It was also revealed that perceived competence at Time 1 had positive effects on sport and exercise involvement at Time 3. On the other hand, sport and exercise involvement at Time 1 had positive effects on perceived competence, ego orientation, effort and enjoyment at Time 3. Finally, age had noticeable negative effects on sport and exercise involvement as well as on task orientation, effort and enjoyment at Time 3.

Discussion

Research revealing the determinants of physical activity provides an important contribution to public health (Sallis & Owen, 1998). A number of intrapersonal variables are considered important determinants of physical activity in youth, including age, self-efficacy and enjoyment (Sallis & Owen, 1998). In line with existing theories (Deci & Ryan, 1985; Harter, 1978; Nicholls, 1989), the present findings indicate that perceived athletic competence, task orientation and intrinsic motivation in physical education are determinants of participation in sport and exercise in adolescence. Physical education accounts for a large percentage of the physical activity requirements of this age group, particularly in densely populated cities such as in the case of Greece (World Health Organization, 2000). The results of this study suggest that aiming for an increase in task orientation, effort and enjoyment in physical education and perceived athletic competence will enhance youngsters' sport and exercise involvement. Moreover, the present findings imply that ego orientation does not determine sport and exercise involvement in Greece. Hence, trying to increase competition among youngsters does not seem fruitful for the promotion of physical activity in youth.

The present study provides clear support for the positive role of perceived athletic competence in determining future participation in sport and exercise in adolescence. According to all social-cognitive theories of motivation (Bandura, 1986;

Table I. Structural equation models investigating the effects of Time 1 variables on Time 3 variables

Paths	Standardized beta	Goodness-of-fit indices
Model 1: Task orientation and SEI		
SEI-1 → Task-3	0.04	χ^2 = 391
Task-1→ SEI-3	0.10**	d.f. = 121
Task-1 → Task-3	0.46***	TLI = 0.915
SEI-1 → SEI-3	0.43***	CFI = 0.929
Age → Task-3	− 0.19***	RMSEA = 0.050
Age → SEI-3	−0.27***	
Model 2: Ego orientation and SEI		
SEI-1 → Ego-3	0.13***	χ^2 = 382
Ego-1→ SEI-3	0.02	d.f. = 99
Ego-1 → Ego-3	0.33***	TLI = 0.931
SEI-1 → SEI-3	0.41***	CFI = 0.943
Age → Ego-3	0.00	RMSEA = 0.057
Age → SEI-3	−0.33***	
Model 3: Perceived competence and SEI		
SEI-1 → PC-3	0.15***	χ^2 = 246
PC-1→ SEI-3	0.17***	d.f. = 72
PC-1 → PC-3	0.43***	TLI = 0.939
SEI-1 → SEI-3	0.37***	CFI = 0.952
Age → PC-3	−0.06	RMSEA = 0.052
Age → SEI-3	−0.28***	
Model 4: Enjoyment and SEI		
SEI-1 → Enjoyment-3	0.10**	χ^2 = 84
Enjoyment-1 → SEI-3	0.13***	d.f. = 30
Enjoyment-1 → Enjoyment-3	0.42***	TLI = 0.981
SEI-1 → SEI-3	0.38***	CFI = 0.987
Age → Enjoyment-3	−0.24***	RMSEA = 0.045
Age → SEI-3	−0.28***	
Model 5: Effort and SEI		
SEI-1 → Effort-3	0.10**	χ^2 = 131
Effort-1 → SEI-3	0.16**	d.f. = 30
Effort-1 → Effort-3	0.48***	TLI = 0.959
SEI-1 → SEI-3	0.39***	CFI = 0.973
Age → Effort-3	−0.26***	RMSEA = 0.045
Age → SEI-3	−0.26***	

Note: SEI = sport and exercise involvement; PC = perceived athletic competence; d.f. = degrees of freedom; TLI = Tucker-Lewis index; CFI = comparative fit index; RMSEA = root mean square error of approximation.
*$P < 0.05$, ***$P < 0.001$.

Deci and Ryan, 1985; Harter, 1978; Weiner, 1985), higher perceived ability keeps students' expectations for success high and motivates them to continue their involvement in sport and exercise. The results of this study clearly indicate that policies aimed at promoting sport and exercise in adolescents should include strategies reinforcing adolescents' perceived athletic ability. Social learning theory (Bandura, 1986) suggests that modelling and verbal persuasion are important means to enhance youngsters' perceptions of competence. In line with the predictions of social learning theory, this study has shown that involvement in sport activities has positive effects on perceived athletic ability. Hence, actions targeting youth behaviour and not just cognition are also required, such as increased opportunities to participate in sport and exercise. The strict selective system of Greek sport foundations and sport clubs excludes from sport involvement large numbers of youngsters who are not selected as talented individuals. These youngsters find it difficult to find somewhere to take part in physical activity in the densely populated cities of Greece. Thus, comprehensive intervention programmes are required that target changes in perceived athletic competence and other intrapersonal variables as well as social and environmental variables simultaneously.

In line with the predictions of achievement goal theory (Dweck, 1986; Nicholls, 1989), task orientation emerged as an important predictor of involvement in youth sport and exercise (Duda & Hall, 2001). Task orientation is linked with adaptive cognitive-affective motivational patterns, such as intrinsic motivation. The present findings are consistent with theory (e.g. Deci & Ryan, 1985; Nicholls, 1989) and previous research findings (e.g., Goudas *et al.*, 1994; Lintunen *et al.*, 1999; Papaioannou & Theodorakis, 1996), suggesting that task orientation and perceived competence determine intrinsic motivation and the latter has a positive impact on physical activity involvement. Hence, policies aimed at fostering both task orientation and intrinsic motivation in physical education should be pursued in the quest to increase participation by youth in physical activity. This can be achieved through the development of a task-involving climate (Ames, 1992) in physical education classes (Papaioannou & Goudas, 1999; Treasure & Roberts, 1995) and the adoption of strategies facilitating self-determination (e.g. Prusak, Treasure, Darst, & Pangrazi, 2004).

Task orientation and intrinsic motivation at Time 1 had a positive impact on physical activity involvement at Time 2 and Time 3. On the other hand, task orientation and intrinsic motivation at Time 2 had no effects on physical activity involvement at Time 3. It should be noted that the Time 1 measures were recorded soon after the beginning of the academic year, when teachers' impact on students' task orientation and intrinsic motivation in physical education was still minor, whereas the Time 2 measures were recorded towards the end of the academic year when they were probably affected by teaching. Moreover, in two previous intervention studies in Greek physical education, the impact of teachers on students' task orientation and intrinsic motivation in physical education towards the end of the academic year did not continue for the next 7 months, when the intervention was over and most of the students had new teachers (Christodoulidis, Papaioannou, & Digelidis, 2001; Digelidis, Papaioannou, Christodoulidis, & Laparidis, 2003). Thus, when teachers' effects are not consistent over the years, a substantial part of teachers' impact on task orientation and intrinsic motivation vanishes. Altogether, these findings may imply that task orientation and intrinsic motivation in physical education are better predictors of sport and exercise involvement when they are assessed at the beginning of the academic year, because at that time students' responses are less dependent on temporary contextual influences, and are more likely to reflect differences between individuals that remain relatively stable across time. These differences between students are probably caused by out-of-school social factors, such as family, peers, sport involvement, and so on. It would be interesting to see if future research adopting a similar methodology would produce similar findings.

It is important to stress that task orientation, intrinsic motivation and perceived sport competence at the beginning of the school year predicted participation in sport and exercise 7 and 14 months later. Hence, the effects of these variables last for a considerable time, which implies that attempts to foster them are worthwhile. Nevertheless, if these effects are pursued through school physical education, they should be consistent – that is, they should be sustained across academic years. The implications go beyond the efforts of individual teachers and they mainly concern education policy makers. Attempts to cultivate task orientation and intrinsic motivation in physical education should primarily be reflected in school curricula and school motivational climate (Maehr & Midgley, 1996). The development of a mastery climate should be pursued at school level and the promotion of task orientation should be a priority of the educational system. This will ensure that the positive influence of teachers will be carried on by their successors in the following years. Only then can we expect positive teaching effects to remain constant across time.

The adjustment of age effects on sport and exercise involvement should be considered a strength of this study. Most studies in the sport motivation literature did not control for age differences. Nevertheless, this study provides support for past research (Papaioannou, 1997a; Digelidis and Papaioannou, 1999) suggesting that there is a considerable reduction in youngsters' motivation in physical education with age. Furthermore, this study showed that during an academic year age had a negative impact on physical activity involvement as well as on task orientation, intrinsic motivation in physical education and perceived athletic competence (Maehr & Midgley, 1996). The loss of motivation in physical activity contexts was more obvious for older Greek students. One might ascribe this to the enhanced interest of older students in a variety of activities that conflicts with their interest in sport and exercise. Nevertheless, this is a rather naïve explanation. Recent research indicates that older adolescents are more likely to consider athletic ability as a fixed entity than younger adolescents and elementary school children (Xiang , Lee, & Williamson, 2001). This has unfortunate consequences for adolescents' motivation in physical activity contexts because they develop a helpless approach with regard to physical ability development (Dweck, 1986). The climate in youth physical activity settings should help adolescents believe that physical ability is a malleable quality that is primarily dependent on effort (Ommundsen, 2001). This will boost their expectations to increase physical competence with practice. At the same time, a mastery environment should be established in school physical education as well as in youth sport and exercise settings. Students should be assisted to set personal goals and to commit themselves to these goals, while at the same time retaining a sense of self-determination (Papaioannou & Goudas, 1999; Treasure & Roberts, 1995).

While task orientation was a determinant of sport and exercise involvement, ego orientation was not. Neither ego orientation at Time 1 nor ego orientation at Time 2 had any effect on subsequent participation in sport and exercise. It is possible that the relationship between ego orientation and participation in sport and exercise that emerged in the cross-sectional data, such as at Time 1 ($r = 0.19$, $P < 0.001$), Time 2 ($r = 0.18$, $P < 0.001$) and Time 3 ($r = 0.13$, $P < 0.001$), reflected the effect of the competitive nature of youth sport on youngsters' goal to show their ability. These findings indicate that adolescents' involvement in sport and exercise affected their perceived athletic competence and this had a temporary impact on their goal to show their ability. However, this effect was not sustained. There was little evidence of a substantial impact of sport and exercise involvement on ego orientation 7 months later. In summary, these results imply that for the Greek students in this study, ego orientation was not a cause but a temporary effect of sport and exercise involvement.

Contrary to theoretical predictions (Nicholls, 1984), we found no evidence of motivational benefits due to an interaction of ego orientation with perceived competence. In a similar vein, the interaction of ego orientation with task orientation had no effect on sport and exercise involvement and intrinsic motivation in physical education. Recently, Grant and Dweck (2003) suggested that for ego-involved individuals focusing primarily on normative comparisons, the motivational consequences are different than for ego-involved persons who primarily strive to validate their ability. The present measure of ego orientation incorporated normative but not ability goal items; however, it is possible that there will be an interaction between perceived competence and a scale including ability goal items. The effects of the interaction of ego orientation with perceived competence and task orientation should be examined in further research. Also, longitudinal and field experimental studies are needed. Findings from laboratory studies (e.g. Elliott & Dweck, 1988) offer a very limited picture of the psychological processes that occur in the complex social environment. Moreover, many statistically significant results revealed by cross-sectional studies (e.g. Duda, 1989) are not sustained for long, an outcome that emerged repeatedly in this study. The results of this study offer little encouragement to those who favour an ego orientation in youth sport and exercise contexts. Taking the present findings in combination with the negative effects of ego orientation on social behavior (e.g. Duda, Olson, & Templin, 1991; Papaioannou, 1997b), the implication for parents and coaches is to lower their emphasis on ego orientation in sport.

One limitation of this study was the large proportion of students who participated in the study but were not matched for Time 1, Time 2 and Time 3 responses. The attrition analysis did not reveal any difference between these students and the 882 students whose data were used here. Hence, we have no idea of knowing whether this decrease in sample size may have influenced the results. Another limitation of the study is concerned with the measurement of behaviour that incorporated both sport and exercise involvement. Although this measure is more ecologically relevant in terms of adolescents' involvement in physical activity settings than a measure focusing solely on either sport or exercise settings, it should be acknowledged that predictions based on achievements goal theory are primarily concerned with sport involvement because sport is an achievement setting. The percentage of Greek adolescents who select competitive sport as their main form of physical activity is substantially higher than the percentage of youngsters who prefer other forms of exercise (Papaioannou, Karastogiannidou, & Theodorakis, 2004) and this may have influenced the results of the present study. Hence, the present conclusions cannot be applied to youngsters who are primarily involved in non-competitive exercise settings and, therefore, further research is needed in this area.

Although we did not focus on measurement issues here, it is important to note that the present instruments exhibited very good psychometric properties. Of particular interest are the moderate stability coefficients for both behavioural and cognitive-affective constructs. Hertzog and Nesselroade (1987) suggested that the magnitude of the stability coefficient can be interpreted as high or low depending upon psychometric concerns and theoretical expectations. The test–retest results presented here are in line with expectations (e.g. Duda & Whitehead, 1998; Fox, 1998). The magnitude of the stability coefficients for the goal orientation variables over a 7 month period was not substantially lower than the magnitude of the test–retest correlation coefficients reported by Duda and Whitehead (1998) for a 3 week period. The magnitude of the test–retest correlation coefficients for the perceived athletic competence scale over a 23 day period (Fox, 1998) was higher than the magnitude of the present stability coefficients, but this should be expected given the longer time interval in the current study. These findings support the reliability of the present measures. In addition, they indicate that the change of sport and exercise involvement, task orientation, perceived competence and intrinsic motivation over 7 and 14 months was noteworthy. This is in line with theories of achievement goals (Nicholls, 1989), intrinsic motivation (e.g. Deci & Ryan, 1985) and effectance motivation (Harter, 1978) that predict a substantial impact of social factors on these social-cognitive variables. This is good news for individuals who wish to intervene using these variables, because there is significant room for their improvement.

The results of this study support the positive role of perceived athletic competence, task orientation and intrinsic motivation in physical education for sport and exercise involvement. Further studies examining the mediator variables between sport and exercise involvement and task orientation, perceived competence and intrinsic motivation are called for. It is important to understand the self-regulation strategies adopted by youngsters who are highly task-oriented and high in perceived competence that trigger their sport and exercise behaviour. Another research avenue should focus on the social factors affecting students' goal orientations and perceived athletic competence. Interventions on motivational climate in physical education are few and far between (e.g. Christodoulidis *et al.*, 2001; Digelidis *et al.*, 2003; Jaakkola, Kokkonen, & Papioannou, 2001; Kokkonen, Jaakkoloa, & Papaioannou, 2001) and further research is needed regarding teaching strategies that cultivate task orientation and intrinsic motivation in physical education (e.g. Goudas, Biddle, Fox, & Underwood, 1995). Finally, the causal relationship of sport and exercise involvement with goal orientations, perceived competence and intrinsic motivation must be investigated in different cultures to determine whether these social-cognitive variables have universal importance. Taking into consideration the importance of physical activity in public health (Bouchard *et al.*, 1994), the study of motivation in physical activity settings is more crucial and challenging than ever before.

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