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Test anxiety in physical education: The predictive role of gender, age, and implicit theories of athletic ability

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Abstract

Test anxiety is experienced by a substantial number of students in many school subjects, including physical education, and it may be deleterious for their school performance and their well-being. The aim of our study was to explore through multiple regression and mediation analyses the relationships between test anxiety in physical education, implicit theories, gender, and age. Five hundred and twenty-six French students ($M_{age} = 15.82$, $SD = 1.19$) voluntarily participated in the study. The results mainly highlighted the following: Gender was a significant predictor of all the components of physical education test anxiety, evidencing that girls scored higher than boys on the four negative components (worry, self-focus, bodily symptoms, somatic tension), and lower on the positive component (perceived control). Age negatively predicted the self-focus component only. Entity theory was a significant predictor of the five components of test anxiety, whereas incremental theory only positively predicted perceived control. Entity theory partially mediated the relationships between gender and perceived control. A better understanding by physical education teachers of the characteristics of their students (e.g. gender differences, age, implicit theories of athletic ability) may contribute to decreasing test anxiety in physical education.

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Introduction

Students are frequently confronted with tests, examinations, and evaluations during their academic life. Examination results may provide academic recognition, but they are also threatening and induce anxiety and worry in each school discipline (Putwain et al., 2010). This is also the case in physical education (PE). The literature studying test anxiety has mainly focused on cognitive skills, evidencing for example its influence on academic performance in standardized cognitive tests. Gender, age, and implicit theories of intelligence have also been studied to highlight their relationship with test anxiety. However, no studies have been carried out to examine, in the specific context of PE, the direct effects of gender, age, and implicit theories of athletic ability on test anxiety. Moreover, the mediating role of implicit theories between demographic variables (gender and age) and test anxiety has never previously been studied. The present study seeks to fill these gaps.

Test anxiety

Examinations leading to a grade or a degree at the end of the learning process represent a significant source of worry and anxiety for students in general, due to threats to esteem/position, negative evaluations by others, fear of failure, or parental pressure (Putwain et al., 2010; Zeidner, 2007). These threats may also be experienced by students during PE tests. In addition to the previous threats, test anxiety can be specifically induced in PE because of the obvious result of the evaluative tasks in front of their classmates and teacher (Barkoukis et al., 2012). Whereas students' performance during examinations in mathematics or geography is often delayed and private, their performance in PE examinations is immediately available and known to all (Barkoukis et al., 2005), which may be an additional source of test anxiety in this school subject, notably for adolescents with a negative body image (Siegel et al., 1999). Moreover, receiving a bad grade in PE or failing a PE examination may be considered anxiety-inducing because it highlights some form of physical incompetence, while being physically active is socially recognized as positive. Consequently, studying test anxiety in the specific context of PE seems to be particularly noteworthy. However, research in this area is scarce despite widespread literature on test anxiety.

Test anxiety, which is considered a specific form of evaluation anxiety (Zeidner and Matthews, 2005), was initially defined as a unidimensional attribute (e.g. Sarason, 1961), before becoming a multidimensional construct. It consists, in the literature, of a cognitive component called "worry" and an affective-physiological component called "emotionality" (Liebert and Morris, 1967). After the development of several scales assessing these two dimensions (e.g. the Test Anxiety Inventory, Spielberger, 1980), the Revised Test Anxiety (RTA, Benson and El-Zahhar, 1994) scale was constructed based on a four-factor conceptualization, including: (a) worry (thoughts related to failure); (b) test-irrelevant thinking (distracting thoughts); (c) tension (general autonomic arousal, e.g. nervousness), and (d) bodily symptoms (specific physiological effects, e.g. headache). Recently, a fifth factor (perceived control) has been added to the four factors of the RTA scale (Danthony et al., in

press) to assess the regulatory dimension of anxiety and measure the capacity to cope and attain the purpose of the task under pressure (Cheng and Hardy, 2016; Cheng et al., 2009). In addition to the cognitive and somatic dimensions of anxiety, Cheng et al. (2009) have introduced perceived control as a fully fledged component of anxiety to better understand anxiety–performance relationships in the sport domain. This component represents an adaptive potential of anxiety to induce positive consequences, directly included in the dynamics of anxiety (Cheng and Hardy, 2016). Specifically, perceived control has been defined in the educational context as the degree of certainty a student has about how to achieve good marks or avoid doing poorly (Martin, 2007). In the PE test anxiety literature, perceived control was found to be positively related to perceived competence, interest in PE, and mastery-approach goals (Danthony et al., in press), which are considered adaptive antecedents and/or outcomes of anxiety and test anxiety. In sum, perceived control is considered a positive component of test anxiety, whereas the four other components are considered negative components. Thus, high perceived control may explain why students succeed in tests although they are cognitively and physiologically anxious.

Several scales have been constructed to measure trait and state anxiety in PE (e.g. Barkoukis et al., 2005), but not specifically test anxiety. To date, only one scale specifically assesses anxiety in PE during tests, labeled the Revised Test Anxiety + Regulatory – Physical Education scale (RTAR-PE) (Danthony et al., in press). To be relevant to the specific context of PE, the RTAR-PE scale was adapted from the initial RTA scale to assess five dimensions of test anxiety in PE: (a) worry (e.g. fear of failure); (b) self-focus (e.g. what others might say or think about their athletic performance during the test); (c) bodily symptoms (e.g. accelerating heartbeats, dry mouth, breathing difficulty); (d) somatic tension (e.g. tiredness, nervousness); and (e) perceived control, which is the regulatory dimension of anxiety (e.g. thinking that the test can be successfully passed). While test anxiety has been extensively studied in relation with numerous frameworks in the academic domain, very little research has been done on the relationships between the different components of test anxiety and implicit theories of intelligence. Moreover, these relationships were not studied in the PE context.

Test anxiety and implicit theories

Following the seminal works of Dweck (Dweck, 1986; Dweck and Leggett, 1988), self-beliefs about the changeability of ability are called implicit theories and have mainly been studied through implicit theories of intelligence. Incremental theorists think that intelligence is an acquirable skill which is improvable with practice and effort, whereas entity theorists see intelligence as fixed, stable, and linked with talent or gift (Dweck and Leggett, 1988). While test anxiety was found to be negatively predicted by different self-beliefs, such as academic self-concept (Arens et al., 2017) or perception of competence (Putwain and Symes, 2012), research specifically focusing on the relationships between test anxiety and implicit theories of intelligence is scarce. For example, the worry dimension of test anxiety was positively predicted by an entity theory of intelligence (Cury et al., 2008), global test anxiety was positively correlated with an entity theory of intelligence (Kumar and Jagacinski, 2006), and Aronson and colleagues (2002) evidenced that promoting an incremental theory reduces test anxiety for stereotyped individuals (e.g. racial minorities, females, low-income students). Despite limited results, studying these relationships is worthwhile because

individuals with high test anxiety perceive tests as a threat, are more susceptible to fear of failure, and often feel helpless (Zeidner, 1998), which are also characteristics of entity "theorists."

In the sport and PE domains, entity and incremental theories about athletic ability were subsequently investigated (e.g. Biddle et al., 2003; Sarrazin et al., 1996). Athletes or students with an incremental theory consider that it is possible to increase athletic ability with effort and regular training. Athletes or students with an entity theory think that athletic ability is stable, genetically determined, and difficult to modify even with hard training (Mascret et al., 2016). To date, no study has been carried out to specifically examine the relationships between implicit theories of athletic ability and test anxiety in PE, but some studies have been conducted with competitive athletes in the sport domain to examine the consequences of implicit theories on anxiety (but not test anxiety). They evidenced that entity and incremental theories were respectively associated with heightened and lowered anxiety (Gardner et al., 2015) and that achievement goals moderate the effects of implicit theories of ability on cognitive anxiety (Stenling et al., 2014). Only one study (Ommundsen, 2001) has examined the relationships between implicit theories of athletic ability and anxiety in PE. It showed that students who endorsed an entity theory in PE had increased levels of anxiety. In general, studies about implicit theories in PE are few in number despite their strong theoretical and practical interests (Warburton and Spray, 2017). Indeed, PE is a relevant context to study implicit theories of ability because this school subject uses some competitive activities, because sport ability is often considered a natural talent (referring to entity theory), and educational values of learning and improvement (referring to incremental theory) are emphasized (Warburton and Spray, 2017). Moreover, incremental theories are associated with a range of positive cognitive, affective, and behavioral outcomes, whereas entity theories are associated with more negative ones, depending on perceived competence (for a recent review in sport, physical activity, and PE, see Vella et al., 2016). Consequently, the hypothesis that incremental theories and entity theories respectively predict the positive (perceived control) components and negative (worry, self-focus, bodily symptoms, somatic tension) components of test anxiety in PE needs to be tested.

The effects of demographic variables

Gender, age, and test anxiety. Individual difference variables such as gender and age must be taken into account for a better understanding of the observed variance in test anxiety scores (Zeidner, 1998). Indeed, gender differences have been highlighted in the test anxiety research. Girls often reported higher test anxiety than boys, especially in the emotionality component of test anxiety (e.g. Putwain, 2007; Putwain and Daly, 2014; Zeidner and Schleyer, 1999). In the stress and coping literature, gender roles, differing temperaments, and levels of vulnerability to threat situations are used to explain gender differences in general anxiety (e.g. Zeidner, 2014). This question has also been investigated in the educational context. While higher anxiety in mathematics is reported by girls than boys (e.g. Good et al., 2012), PE is also a school subject in which gender differences may occur, because sports are often gender-typed (most often as masculine), because girls score lower than boys on physical self-concept, and boys are more likely than girls to think that it is important to succeed in sports and PE (Klomsten et al., 2005). Only one study (Danthony et al., in press) has investigated gender differences in PE test anxiety and evidenced that worry, self-focus, bodily symptoms, and somatic tension were higher for girls than for boys, whereas perceived control was higher for boys than for girls.

Furthermore, students of all ages are confronted with test anxiety, and age may influence the experience and expression of test anxiety (Nyroos et al., 2015; Wren and Benson, 2004), with

primary school children experiencing more physical symptoms and fewer cognitive symptoms (Whitaker Sena et al., 2007). Results are less consistent for the influence of age on test anxiety than for the influence of gender. Hembree's (1988) meta-analysis evidenced that test anxiety increased in the early elementary school grades and remained constant throughout the junior high and high school years, whereas Wigfield and Eccles (1989) evidenced that test anxiety increased in junior high school and leveled off during the high school years. In any event, it is essential to take age into account when explaining the variance in students' test anxiety scores (Zeidner, 1998). This is all the more important in PE because adolescents' body image changes throughout the curriculum (Siegel et al., 1999) and may reinforce test anxiety, especially the self-focus component (e.g. what others might say or think about their athletic performance during the test) when students must perform their evaluation in front of classmates. However, the influence of age on test anxiety has not been investigated in the PE context.

Gender, age, and implicit theories of ability. Relationships between implicit theories of athletic ability, gender, and age have also been discussed in the literature, evidencing mixed results. No consistent pattern was found for gender differences in the adoption of implicit theories of ability (Warburton and Spray, 2008). Biddle et al. (2003) evidenced that the multidimensional hierarchical structure of their scale assessing implicit theories of athletic ability was invariant across gender. In an experimental study using a sport task, Spray et al. (2006) did not find interactive effects between self-theories of ability and gender. In contrast, Ommundsen (2001) highlighted that gender differences appeared in PE: boys were more likely to consider ability a natural gift (i.e. entity theory) than girls. This result was confirmed by the study of Li et al. (2006), in which natural ability was rated as more influential for successful skill level or performance by boys than by girls, but differences for gender-linked activities were found. Finally, girls were less likely to adopt an incremental theory of athletic ability than boys (Li et al., 2004) and the review of Vella et al. (2016) showed that participant gender moderated the relationship between incremental beliefs and adaptive outcomes. Consequently, it is interesting to study whether entity and incremental theories may mediate the relationship between gender and the non-adaptive dimensions (worry, self-focus, bodily symptoms, somatic tension) and the adaptive dimension (perceived control) of test anxiety. Concerning age, it might have been expected that ability beliefs would be stronger among older children because they are more capable of discriminating between ability and effort than younger children (Fry and Duda, 1997) and that the benefits of incremental beliefs would increase during high school (e.g. Yeager et al., 2014). However, Warburton and Spray (2008) showed that entity and incremental beliefs remained stable across the primary to secondary school transition in PE, and the review of Vella et al. (2016) in the sport, physical activity, and PE domains failed to find a moderating role of age, due to the lack of systematically conducted research.

The present research

The aim of our study was to understand the relationships between test anxiety in the specific context of PE, and gender, age, and implicit theories of athletic ability. First, we examined whether the two implicit theories of athletic ability, gender, and age were direct predictors of the different components of test anxiety in PE. We hypothesized that entity theory would positively predict the four negative components of test anxiety and that incremental theory would positively predict perceived control. We also expected gender to be a negative predictor of the four negative components of test anxiety in PE (worry, self-focus, bodily symptoms, somatic tension), and a positive

predictor of perceived control. Secondly, we investigated the potential mediating role of implicit theories on the relationships between gender, age, and test anxiety in PE. We expected that entity theories would mediate the relationships between gender and the negative components of test anxiety, and that incremental theory would mediate the relationship between gender and perceived control. Due to the lack of significant evidence in the test anxiety and implicit theories literatures, no a priori hypotheses were formulated for the predicting role of age on test anxiety or for the mediation of implicit theories of ability between age and the five test anxiety components.

Method

Participants and procedure

Five hundred and twenty-six French students (326 girls, 200 boys, $M_{age} = 15.82$, $SD = 1.19$, age range 12–19) from six *collèges* (ages 13–15, 191 students, 131 girls, 60 boys, $M_{age} = 14.58$, $SD = 0.76$) and *lycées* (ages 15–18, 335 students, 195 girls, 140 boys, $M_{age} = 16.53$, $SD = 0.72$) in the south of France voluntarily participated in the study. These schools follow the most recent French official PE curricula for *collèges* (2015) and *lycées* (2010), in which motor skills (e.g. techniques, coordination) and methodological and social skills (e.g. cooperation, self-regulation) must be developed through different sport activities (e.g. basketball, swimming), artistic activities (e.g. dance), and developmental activities (e.g. muscle training). All these skills are evaluated through specific tests at the end of the learning sequence (6–10 PE lessons). For example, French students are often evaluated in middle-distance running through three criteria: the total distance covered during the time provided (e.g. nine minutes), the percentage of the VO2max (i.e. the maximum rate of oxygen consumption) used by the student during their run (e.g. running at 80% of their VO2max for nine minutes), and the race plan (e.g. anticipating before the start of the race the distance which will be covered). The different kinds of PE curriculum models (e.g. Sport Education, Siedentop, 1994; Teaching Games for Understanding, Bunker and Thorpe, 1982) were not investigated in the present study because these models are not explicitly used by French PE teachers.

The Chief Education Officer, the schools' principals, and the students' parents had approved the study. Questionnaires were completed by the participants just before the beginning of PE lessons conducted by nine experienced teachers (at least eight years of experience in teaching PE; four women, five men), on a day without evaluations, tests or examinations. Written instructions made clear that the students' responses would remain anonymous and that they would not influence their course grade. The procedure was supervised by the two first authors and the class teacher, and lasted approximately 10 minutes.

Measures

Test anxiety. Test anxiety was assessed with the RTAR-PE scale (Danthony et al., in press). Participants responded to the four items assessing worry (e.g. "During PE tests, I am afraid of failure"), the three items assessing self-focus (e.g. "During PE tests, I am conscious that other students will judge my performance negatively"), the four items assessing bodily symptoms (e.g. "During PE tests, my heart beats more strongly than during PE lessons"), the four items assessing somatic tension (e.g. "During PE tests, I am more nervous than during PE lessons"), and the four items assessing perceived control (e.g. "During PE tests, I believe that I can get a good grade") using a four-point scale (almost never to almost always). Internal consistency was satisfactory for worry

($\alpha = .77$), self-focus ($\alpha = .93$), bodily symptoms ($\alpha = .76$), somatic tension ($\alpha = .86$), and perceived control ($\alpha = .93$).

Implicit theories of athletic ability. A French translation of the Conceptions of the Nature of Athletic Ability Questionnaire – 2 (CNAAQ-2) (Biddle et al., 2003) was used to assess entity and incremental theories of ability. This French version had already been used in previous studies (e.g. Mascret et al., 2015). Participants responded to the six items assessing entity theory (e.g. "It is difficult to change how good you are at PE") and the six items assessing incremental theory (e.g. "In PE, if you work hard at it, you will always get better") using a 1 (strongly disagree) to 5 (strongly agree) scale. Internal consistency was satisfactory for both entity theory ($\alpha = .82$) and incremental theory ($\alpha = .74$).

Data analyses

Preliminary analyses. Firstly, the dataset was screened for missing values. Secondly, gross outliers were detected using Mahalanobis distance ($p < .001$) at the multivariate level (In'nami and Koizumi, 2013). Thirdly, an indication of univariate normality was provided by skewness and kurtosis estimates, with variables non-normal in distribution signaled by values $\geq |2|$ for skewness and $\geq |7|$ for kurtosis (Curran et al., 1996). Fourthly, a CFA using the Lisrel 9.1 programme was conducted on the covariance matrix of the items of the RTAR-PE and the CNAAQ-2 scales, and the solution was generated using maximum likelihood estimation. The fit indices were the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the incremental fit index (IFI). Following Byrne's (2010) recommendations, the criteria for a good-fitting model were CFI $\geq .95$; IFI $\geq .95$; and RMSEA $\leq .05$, and the criteria for an acceptable fitting model were CFI $\geq .90$; IFI $\geq .90$; and RMSEA $\leq .08$. Other researchers have suggested RMSEA $\leq .10$ and CFI and IFI close to .90 as acceptable values (Blunch, 2008). Concerning SRMR, a value less than .08 is considered a good fit (Hu and Bentler, 1999). Fifthly, measurement invariance across gender was assessed following the main steps identified by Putnick and Bornstein (2016), including configural levels (i.e. the constructs have the same pattern of free and fixed loadings across gender), metric levels (i.e. each item contributes to the latent construct to a similar degree across gender), and scalar levels (i.e. mean differences in the latent construct capture all mean differences in the shared variance of the items). If a step is not supported, the next step is not investigated. While consensus on the best fit indices and values to confirm measurement invariance was not found (Putnick and Bornstein, 2016), we based our data analysis on Chen's (2007) work, which suggests a criterion of a –.01 change in CFI and a .015 change in RMSEA to validate a step. The lavaan package of the *R* software (Rosseel, 2012) was used to perform measurement invariance analyses using structural equation modelling. Sixthly, potential gender differences in the RTAR-PE and the CNAAQ-2 scales were indicated by a multivariate analysis of variance. Finally, internal consistency was estimated using Cronbach's α, which must be above .70 to be considered satisfactory (Nunnally and Bernstein, 1994).

Primary analyses. Following the procedure of Madigan et al. (2018), three regression analyses were subsequently conducted to examine: (a) how gender (girls = 0, boys = 1) and age predicted the five test anxiety components (Model 1); (b) how the two implicit theories of ability predicted them (Model 2); and (c) how the combination of gender, age, and implicit theories of ability predicted

Table 1. Summary of multiple regression analyses predicting test anxiety components.

	Worry		Self-focus		Bodily symptoms		Somatic tension		Perceived control	
	R^2	β	R^2	β	R^2	β	R^2	β	R^2	β
Model 1	.10***		.06***		.02**		.04***		.17***	
Gender		–0.32***		–0.21***		–0.14***		–0.19***		0.41***
Age		0.02		–0.09*		0.05		0.07		0.03
Model 2	.08***		.07***		.05***		.07***		.15***	
Entity		0.26***		0.23***		0.20***		0.26***		–0.27***
Incremental		–0.06		–0.05		–0.04		–0.02		0.18***
Model 3										
Step 1									.17***	
Gender										0.41***
Step 2									.26***	
Gender										0.38***
Incremental										0.26***

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

the test anxiety components (Model 3). For Model 1, gender and age were entered simultaneously into the regression (see Table 1). For Model 2, we entered the two implicit theories of ability simultaneously into the regression. Following the procedures of Tabachnick and Fiddell (2007) and Madigan et al. (2018) for Model 3, we entered only the significant predictors from Model 1 and Model 2. The significance of the main effect between gender (or age) and the test anxiety variables would be reduced in the case of partial mediation, or would become non-significant in the case of full mediation, when the mediating variable (entity theory and/or incremental theory) is accounted for (Baron and Kenny, 1986). To test potential mediation, the size and significance of the indirect effect were examined using PROCESS (Hayes, 2013), running the mediational model with 5000 bootstraps. The test can be considered significant at the $p < .05$ level if the 95% confidence interval (CI) does not contain zero (Preacher and Hayes, 2008). These statistical analyses were performed using SPSS software (version 18 for Windows) and Statistica (version 12 for Windows). Separate hierarchical regression analyses were conducted in the present research to be in line with previous studies that have used the same statistical procedure to investigate the influence of socio-demographic variables (e.g. gender, age) on the different components of test anxiety (e.g. Putwain, 2007). Moreover, this procedure, completed by mediational analysis through the PROCESS macro, was used in Madigan et al.'s (2018) study. It produced substantively identical results comparatively to structural equation modelling (Hayes et al., 2017).

Results

Preliminary results

Because a very small proportion of the sample data were missing (< 0.1%), these data were imputed, replacing missing values with the scale mean. Fourteen participants showed a Mahalanobis distance larger than the critical value of $\chi^2(9) = 27.88$, $p < .001$. Consequently, they were flagged as multivariate outliers and they were excluded from the study. The main analyses were

then conducted on a final sample of 512 participants. Based on the values recommended by Curran et al. (1996), univariate skewness (maximum = –1.200) and kurtosis (maximum = 1.975) statistics showed that the measures were approximately normal in distribution for the test anxiety and implicit theories variables. Following Arbuckle and Worthke (1999), these results justified the use of the maximum likelihood method for estimating the parameters.

The hypothesized five-factor structure of the 19-item RTAR-PE scale was supported by the results of the CFA. The fit statistics met the criteria for an acceptable fitting model (Byrne, 2010; Hu and Bentler, 1999): $\chi^2(142, N = 512) = 607.52$, $p < .001$, CFI = .97, IFI = .97, SRMR = .07, RMSEA = .06. The hypothesized two-factor structure of the 12-item CNAAQ-2 scale was also supported following the recommendations of Blunch (2008): $\chi^2(43, N = 512) = 397.74$, $p < .001$, CFI = .90, IFI = .90, SRMR = .08, RMSEA = .10.

The RTAR-PE scale assessing test anxiety was invariant across gender at the configural, metric, and scalar levels (i.e. CFI values change $\leq .01$; RMSEA value change $\leq .015$, Chen, 2007), while the CNAAQ-2 assessing implicit theories of athletic ability was invariant at the configural and metric levels.

Some potential gender differences in the measures used in the present study were indicated by a multivariate analysis of variance (Wilks' lambda = 0.792; $F(7, 504) = 18.901$, $p < .001$, $\eta^2 = 0.21$). Gender differences were highlighted with follow-up univariate analyses and were found for worry ($F(1, 510) = 53.341$, $p < .001$, $\eta^2 = 0.10$; $M = 1.81$, $SD = 0.67$ for boys, $M = 2.30$, $SD = 0.74$ for girls), self-focus ($F(1, 510) = 25.806$, $p < .001$, $\eta^2 = 0.05$; $M = 1.53$, $SD = 0.71$ for boys, $M = 1.93$, $SD = 0.96$ for girls), bodily symptoms ($F(1, 510) = 10.413$, $p = .001$, $\eta^2 = 0.02$; $M = 1.52$, $SD = 0.63$ for boys, $M = 1.71$, $SD = 0.68$ for girls), somatic tension ($F(1, 510) = 18.749$, $p < .001$, $\eta^2 = 0.04$; $M = 1.45$, $SD = 0.60$ for boys, $M = 1.75$, $SD = 0.84$ for girls), perceived control ($F(1, 510) = 101.606$, $p < .001$, $\eta^2 = 0.17$; $M = 3.24$, $SD = 0.71$ for boys, $M = 2.54$, $SD = 0.81$ for girls), and incremental theory ($F(1, 510) = 5.300$, $p = .022$, $\eta^2 = 0.01$; $M = 4.29$, $SD = 0.66$ for boys, $M = 4.14$, $SD = 0.71$ for girls). No significant gender differences were found for entity theory.

Finally, as seen previously, all the Cronbach's alphas were higher than .70 for the different subscales of test anxiety (ranging from .76 to .93) and implicit theories (ranging from .74 to .82) scales. Consequently, internal consistencies were satisfactory following the recommendations of Nunnally and Bernstein (1994).

Correlations between test anxiety and implicit theories of ability

Incremental theory was negatively correlated with worry, self-focus, bodily symptoms and somatic tension, and positively correlated with perceived control and gender. Entity theory was positively correlated with worry, self-focus, bodily symptoms, and somatic tension, and negatively related to perceived control. The detailed correlations and descriptive statistics are presented in Table 2.

Regression and mediational analyses

Model 1 examined how gender and age predicted the five test anxiety components. The model explained 10% of the variance in worry, 6% in self-focus, 2% in bodily symptoms, 4% in somatic tension, and 17% in perceived control. Gender negatively predicted worry, self-focus, bodily symptoms, and somatic tension, and positively predicted perceived control. Age negatively predicted self-focus only. Model 2 examined how the two implicit theories of

Table 2. Descriptive statistics of the final sample (without outliers) and correlations between scales.

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Worry	2.11	0.75	–								
2. Self-focus	1.78	0.89	.58***	–							
3. Bodily symptoms	1.64	0.67	.42***	.30***	–						
4. Somatic tension	1.63	0.77	.62***	.45***	.57***	–					
5. Perceived control	2.81	0.84	–.48***	–.45***	–.26***	–.37***	–				
6. Entity theory	1.82	0.78	.29***	.25***	.21***	.26***	–.34***	–			
7. Incremental theory	4.20	0.69	–.17***	–.14**	–.12**	–.13**	.30***	–.43***	–		
8. Gender	–	–	–.32***	–.22***	–.14**	–.19***	.41***	–.03	.10*	–	
9. Age	15.83	1.21	–.00	–.10*	.04	.06	.05	.04	.05	.05	–

Notes. *$p < .05$, **$p < .01$, ***$p < .001$, *M*: Mean, *SD*: Standard Deviation, Gender (boys = 1, girls = 0).

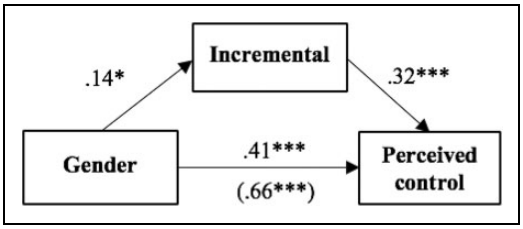

Figure 1. Incremental theory partially mediates the relationship between gender and perceived control (standardized regression coefficients; *$p < .05$, **$p < .01$, ***$p < .001$).

ability predicted the five test anxiety components. The model explained 8% of the variance in worry, 7% in self-focus, 5% in bodily symptoms, 7% in somatic tension, and 15% in perceived control. Entity theory positively predicted worry, self-focus, bodily symptoms and somatic tension, and negatively predicted perceived control, while incremental theory positively predicted perceived control only.

We entered in Model 3 only the significant predictors from Model 1 and Model 2. Because gender and age were not significantly related to entity theory (see Table 2), entity theory was not studied as a mediator between gender, age, and the different components of test anxiety (Baron and Kenny, 1986). Consequently, gender was entered in Step 1 and incremental theory was entered in Step 2 for predicting perceived control only. The model explained 26% of the variance in perceived control. Moreover, the effect of gender was reduced in size when incremental theory was added to the model but remained significant, indicating a potential partial mediation (Baron and Kenny, 1986). These results suggested that gender both showed a direct relationship with perceived control and was partially mediated through incremental theory (see Figure 1). The results of the PROCESS macro confirmed that the partial mediation effect was significant (indirect effect = 0.05 [95% CI = 0.006–0.092]).

Discussion

The aim of our study was to investigate in PE settings the relationships between the different dimensions of test anxiety and implicit theories of athletic ability, gender, and age. Despite a lack

of studies explicitly investigating the relationships between test anxiety and implicit theories in the educational context, our results are in line with the theoretical framework of implicit theories of athletic ability. Firstly, entity theory positively predicted worry, self-focus, bodily symptoms, and somatic tension (i.e. the four negative components of test anxiety). The review of Vella et al. (2016) evidenced that entity theories are associated with more negative cognitive, affective, and behavioral outcomes than incremental theories. Moreover, levels of anxiety increased for students who endorsed an entity theory in PE because they believe that effort is useless to develop ability in PE (Ommundsen, 2001). In achievement situations, negative affective responses such as test anxiety may be induced by attributing failure to uncontrollable and stable reasons (Weiner, 1985). "Entity theorists" are more likely to be subject to test anxiety, because when they encounter failure they think that their future result will be inadequate since their current result is negative. This phenomenon may be reinforced in PE settings due to the salience of failure and the public evaluation of competence (Warburton and Spray, 2017), which is especially acute during PE tests or examinations. Secondly, entity theory negatively predicted perceived control. This result is consistent with expectations because it is hardly conceivable that one would have a high perceived control of a stable and fixed belief about athletic ability, which in any case is not considered controllable and improvable despite training and effort. Thirdly, incremental theory was found to be a positive predictor of perceived control. This result is also consistent with the literature because incremental theorists focus on improving their ability, make attributions to controllable factors, and consider failure an inevitable part of the learning process (Warburton and Spray, 2017), which can further increase perceived control during tests and examinations in PE. Taken together, these results indicate that despite all the positive cognitive, affective, and behavioral outcomes related to incremental theories (Vella et al., 2016), promoting the adoption of incremental theories is not sufficient to reduce PE test anxiety if the adoption of entity theories is not simultaneously reduced.

The main effects of demographic variables on the five components of test anxiety in PE were also highlighted. Gender negatively predicted worry, self-focus, bodily symptoms, and somatic tension, and positively predicted perceived control. This result in PE settings is consistent with the literature on test anxiety in general, in which girls often reported higher test anxiety than boys, but gender differences were smaller than in our study conducted in the PE context. The theoretical framework of stereotype threat (Steele and Aronson, 1995) may be relevant in discussing this result since women have been stereotyped as physically and biologically inferior to men, especially in the sport domain (Li et al., 2004). These expectations of society have limited women's participation in sport and physical activity. Indeed, participation has declined among all subgroups of adolescents for many years, especially among girls (Luiggi et al., 2018). This stereotype threat may heighten test anxiety for many girls who do not feel able to succeed in PE tests or examinations. Conversely, sport is often considered a masculine domain, and more boys think that is it important to succeed in sport and PE comparatively to girls (Klomsten et al., 2005). Indeed, we have evidenced that boys have higher perceived control than girls in this regulatory dimension of test anxiety.

Concerning age, only self-focus was negatively predicted by this variable. This result is not surprising since our sample was mainly composed of students aged 14 to 18. Adolescents' advancing cognitive development when they are 14–15 years old makes it possible for them to adopt the perspectives of others and consequently they become more sensitive to others' judgment and evaluation during this specific period (Bluth and Blanton, 2015). While they often engage in self-criticism and self-doubt when they compare themselves with their peers and classmates (Steinberg, 1999), self-focus may tend to increase during this period because it is a component of test anxiety based on what others might say or think about one's own athletic performance during

the test. The risk of being rejected by peers if they fail the test may contribute to the increase in this specific component of test anxiety for the youngest students in our sample comparatively to the oldest ones, for whom this kind of risk has become less important.

Finally, our study showed a partial mediation of incremental theory between gender and perceived control. Girls experienced less perceived control than boys and were less likely to endorse incremental theories. The stereotypical acceptance of girls' inferiority in the sport domain is often associated with learned helplessness (Li et al., 2004), in which individuals consider failure uncontrollable and think that nothing can be done to overcome it (Seligman, 1975). If girls are less likely to adopt an incremental theory than boys, they consider athletic ability less modifiable and less changeable, and consequently they consider they have less possibility of changing it during PE tests and examinations, which may lead to decreases in perceived control.

This study is not without limitations and future studies may be envisaged. Firstly, this study is only correlational, and inclusion of outcomes such as PE grades is a promising way to highlight the consequences on non-self-reported PE performance. Secondly, while gender and age were used as relevant predictors of test anxiety in the present study, it must be noted that the effects of predictors on outcome variables are often examined to subsequently manipulate them to change the effect on outcome variables, which is impossible with gender or age. Thirdly, one key element of the achievement motivation model (Dweck, 1986; Dweck and Leggett, 1988), namely the interaction between entity theory and perceived competence, has not to date been investigated in the PE domain (Warburton and Spray, 2017). According to this model, we may hypothesize that a student with a high perceived competence in PE adopting an entity theory should produce more adaptive outcomes, including reduced levels of worry, self-focus, bodily symptoms, and somatic tension, and increased levels of perceived control. However, this hypothesis needs to be tested in future research. Finally, test anxiety in PE classes was measured in general. Contextual factors such as curriculum aspects and variations across classes, schools, and activities need to be included in future studies. For example, some sport activities may induce a specific test anxiety. During PE tests or examinations in team sports, more partners and opponents may judge the performance during the test than in individual sport activities. Some physical activities (e.g. dance, artistic gymnastics) are also considered gender-typed as feminine. Gender differences in PE test anxiety found in the present study may belong to these kinds of physical activities. Moreover, examining the effects on the PE test anxiety of some PE curriculum models (e.g. Sport Education, Siedentop, 1994; Teaching Games for Understanding, Bunker and Thorpe, 1982), some motivational climates (empowering vs disempowering climates, Smith et al., 2015), and some reorganized curriculum aspects (e.g. leaving out testing in PE) is a promising way to develop fine-tuned research in the PE test anxiety area and to minimize the detrimental effects of the entity theory of ability in the PE context (Warburton and Spray, 2017).

Conclusion

Studying test anxiety in PE settings is particularly relevant because on the one hand this school subject is experienced by all students during their schooling, and on the other hand bad experiences during PE courses (e.g. high and frequent test anxiety) can lead to physical inactivity across the lifespan (Warburton and Spray, 2017). We have highlighted that implicit theories of athletic ability, gender, and age were significant predictors of the different negative and positive dimensions of PE test anxiety. A better understanding of the psychological characteristics of their students by PE teachers may decrease test anxiety in this school subject, increase the probability of

success during PE tests and examinations, and promote physically active lifestyles outside PE classes.

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References

Arbuckle JL and Worthke W (1999) *AMOS 4.0 user's guide*. Chicago: SmallWaters.

Arens AK, Becker M and Möller J (2017) Social and dimensional comparisons in math and verbal test anxiety: Within- and cross-domain relations with achievement and the mediating role of academic self-concept. *Contemporary Educational Psychology* 51: 240–252.

Aronson J, Fried CB and Good C (2002) Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology* 38(2): 113–125.

Barkoukis V, Rodafinos A, Koidou E, et al. (2012) Development of a scale measuring trait anxiety in physical education. *Measurement in Physical Education and Exercise Science* 16(4): 237–253.

Barkoukis V, Tsorbatzoudis H, Grouios G, et al. (2005) The development of a physical education state anxiety scale: A preliminary study. *Perceptual and Motor Skills* 100(1): 118–128.

Baron RM and Kenny DA (1986) The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 51(6): 1173–1182.

Benson J and El-Zahhar N (1994) Further refinement and validation of the Revised Test Anxiety Scale with cross-validation. *Structural Equation Modelling* 1(3): 203–221.

Biddle SJ, Wang CJ, Chatzisarantis NL, et al. (2003) Motivation for physical activity in young people: Entity and incremental beliefs about athletic ability. *Journal of Sports Sciences* 21(12): 973–989.

Blunch NJ (2008) *Introduction to structural equation modelling using SPSS and AMOS*. London, UK: SAGE.

Bluth K and Blanton PW (2015) The influence of self-compassion on emotional well-being among early and older adolescent males and females. *The Journal of Positive Psychology* 10(3): 219–230.

Bunker D and Thorpe R (1982) A model for the teaching of games in the secondary school. *Bulletin of Physical Education* 18(1): 5–8.

Byrne BM (2010) *Structural equation modelling with AMOS: Basic concepts, applications, and programming*. New York, NY: Routledge.

Chen FF (2007) Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling* 14(3): 464–504.

Cheng WNK and Hardy L (2016) Three-dimensional model of performance anxiety: Tests of the adaptive potential of the regulatory dimension of anxiety. *Psychology of Sport and Exercise* 22: 255–263.

Cheng WNK, Hardy L and Markland D (2009) Toward a three-dimensional conceptualization of performance anxiety: Rationale and initial measurement development. *Psychology of Sport and Exercise* 10(2): 271–278.

Curran PJ, West SG and Finch JF (1996) The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods* 1(1): 16–29.

Cury F, Da Fonseca D, Zahn I, et al. (2008) Implicit theories and IQ test performance: A sequential mediational analysis. *Journal of Experimental Social Psychology* 44(3): 783–791.

Danthony S, Mascret N and Cury F (in press) Development and validation of a scale assessing test anxiety in physical education. *Journal of Teaching in Physical Education*.

Dweck CS (1986) Motivational processes affecting learning. *American Psychologist* 41(10): 1040–1048.
Dweck CS and Leggett E (1988) A social-cognitive approach to motivation and personality. *Psychological Review* 95(2): 256–273.
Fry MD and Duda JL (1997) A developmental examination of children's understanding of effort and ability in the physical and academic domains. *Research Quarterly for Exercise and Sport* 68(4): 331–344.
Gardner LA, Vella SA and Magee CA (2015) The relationship between implicit beliefs, anxiety, and attributional style in high-level soccer players. *Journal of Applied Sport Psychology* 27(4): 398–411.
Good C, Rattan A and Dweck CS (2012) Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology* 102(4): 700–717.
Hayes AF (2013) *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. London: Guilford.
Hayes AF, Montoya AK and Rockwood NJ (2017) The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. *Australasian Marketing Journal* 25(1): 76–81.
Hembree R (1988) Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research* 58(1): 47–77.
Hu LT and Bentler PM (1999) Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal* 6(1): 1–55.
In'nami Y and Koizumi R (2013) Structural equation modeling in educational research: A primer. In: Khine M (ed.) *Application of Structural Equation Modeling in Educational Research and Practice*. Rotterdam: Sense Publishers, pp.23–51.
Klomsten AT, Marsh HW and Skaalvik EM (2005) Adolescents' perceptions of masculine and feminine values in sport and physical education: A study of gender differences. *Sex Roles* 52(9–10): 625–636.
Kumar S and Jagacinski CM (2006) Imposters have goals too: The imposter phenomenon and its relationship to achievement goal theory. *Personality and Individual Differences* 40(1): 147–157.
Li W, Harrison L, Jr and Solmon M (2004) College students' implicit theories of ability in sports: Race and gender differences. *Journal of Sport Behavior* 27(3): 291–304.
Li W, Lee AM and Solmon MA (2006) Gender differences in beliefs about the influence of ability and effort in sport and physical activity. *Sex Roles* 54(1–2): 147–156.
Liebert RM and Morris LW (1967) Cognitive and emotional components of test anxiety: A distinction and some initial data. *Psychological Reports* 20: 975–978.
Luiggi M, Travert M and Griffet J (2018) Temporal trends in sports participation among adolescents between 2001 and 2015: A French school- and territory-based study. *International Journal of Environmental Research and Public Health* 15(7): 1335.
Madigan DJ, Stoeber J, Culley T, et al. (2018) Perfectionism and training performance: The mediating role of other-approach goals. *European Journal of Sport Science* 18(9): 1271–1279.
Martin AJ (2007) Examining a multi-dimensional model of student motivation and engagement using a construct validation approach. *British Journal of Educational Psychology* 77(2): 412–440.
Mascret N, Elliot AJ and Cury F (2015) Extending the 3 × 2 achievement goal model to the sport domain: The 3 × 2 Achievement Goal Questionnaire for Sport. *Psychology of Sport and Exercise* 17: 7–14.
Mascret N, Falconetti JL and Cury F (2016) Implicit measures of beliefs about sport ability in swimming and basketball. *European Journal of Sport Science* 16(3): 358–364.
Nunnally JC and Bernstein IH (1994) *Psychometric Theory* (3rd ed.). New York: McGraw-Hill.
Nyroos M, Korhonen J, Peng A, et al. (2015) Cultural and gender differences in experiences and expression of test anxiety among Chinese, Finnish and Swedish grade 3 pupils. *International Journal of School and Educational Psychology* 3(1): 37–48.
Ommundsen Y (2001) Self-handicapping strategies in physical education classes: The influence of implicit theories of the nature of ability and achievement goal orientations. *Psychology of Sport and Exercise* 2(3): 139–156.
Preacher KJ and Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 40: 879–891.

Putnick DL and Bornstein MH (2016) Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental Review* 41: 71–90.

Putwain DW (2007) Test anxiety in UK schoolchildren: Prevalence and demographic patterns. *British Journal of Educational Psychology* 77(3): 579–593.

Putwain D and Daly AL (2014) Test anxiety prevalence and gender differences in a sample of English secondary school students. *Educational Studies* 40(5): 554–570.

Putwain DW and Symes W (2012) Achievement goals as mediators of the relationship between competence beliefs and test anxiety. *British Journal of Educational Psychology* 82(2): 207–224.

Putwain DW, Connors L and Symes W (2010) Do cognitive distortions mediate the test anxiety–examination performance relationship? *Educational Psychology* 30(1): 11–26.

Rosseel Y (2012) Lavaan: An R package for structural equation modeling. *Journal of Statistical Software* 48(2): 1–36.

Sarason IG (1961) Test anxiety and the intellectual performance of college students. *Journal of Educational Psychology* 52(4): 201–206.

Sarrazin P, Biddle S, Famose JP, et al. (1996) Goal orientations and conceptions of the nature of sport ability in children: A social cognitive approach. *British Journal of Social Psychology* 35(3): 399–414.

Seligman ME (1975) *Helplessness: On Depression, Development, and Death. A Series of Books in Psychology*. New York: WH Freeman/Times Books/Henry Holt & Co.

Siedentop D (1994) *Sport Education: Quality PE Through Positive Sport Experiences*. Champaign, IL: Human Kinetics.

Siegel JM, Yancey AK, Aneshensel CS, et al. (1999) Body image, perceived pubertal timing, and adolescent mental health. *Journal of Adolescent Health* 25(2): 155–165.

Smith N, Tessier D, Tzioumakis Y, et al. (2015) Development and validation of the multidimensional motivational climate observation system. *Journal of Sport and Exercise Psychology* 37(1): 4–22.

Spielberger CD (1980) *Preliminary Professional Manual for the Test Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Spray CM, Wang CKJ, Biddle SJH, et al. (2006) An experimental test of self-theories of ability in youth sport. *Psychology of Sport and Exercise* 7(3): 255–267.

Steele CM and Aronson J (1995) Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology* 69(5): 797–811.

Steinberg L (1999) *Adolescence*. Boston: McGraw Hill-College.

Stenling A, Hassmén P and Holmström S (2014) Implicit beliefs of ability, approach-avoidance goals and cognitive anxiety among team sport athletes. *European Journal of Sport Science* 14(7): 720–729.

Tabachnick BG and Fidell LS (2007) *Using Multivariate Statistics* (5th ed.). Boston: Pearson.

Vella SA, Braithewaite RE, Gardner LA, et al. (2016) A systematic review and meta-analysis of implicit theory research in sport, physical activity, and physical education. *International Review of Sport and Exercise Psychology* 9(1): 191–214.

Warburton V and Spray C (2008) Motivation in physical education across the primary—secondary school transition. *European Physical Education Review* 14(2): 157–178.

Warburton VE and Spray CM (2017) Implicit theories of ability in physical education: Current issues and future directions. *Journal of Teaching in Physical Education* 36(3): 252–261.

Weiner B (1985) An attributional theory of achievement motivation and emotion. *Psychological Review* 92(4): 548–573.

Whitaker Sena JD, Lowe PA and Lee SW (2007) Significant predictors of test anxiety among students with and without learning disabilities. *Journal of Learning Disabilities* 40(4): 360–376.

Wigfield A and Eccles JS (1989) Test anxiety in elementary and secondary school students. *Educational Psychologists* 24(2): 159–183.

Wren DG and Benson J (2004) Measuring test anxiety in children: Scale development and internal construct validation. *Anxiety, Stress, and Coping* 17(3): 227–240.

Yeager DS, Johnson R, Spitzer BJ, et al. (2014) The far-reaching effects of believing people can change: Implicit theories of personality shape stress, health, and achievement during adolescence. *Journal of Personality and Social Psychology* 106(6): 867–884.

Zeidner M (1998) *Test Anxiety: The State of the Art*. New York: Plenum Press.

Zeidner M (2007) Test anxiety in educational contexts. In: Schutz PA and Pekrun R (eds) *Emotion in Education*. Burlington, MA: Elsevier, pp.165–184.

Zeidner M (2014) Anxiety in education. In: Pekrun R and Linnenbrink-Garcia L (eds) *Educational Psychology Handbook Series. International Handbook of Emotions in Education*. New York: Routledge/Taylor & Francis Group, pp.265–288.

Zeidner M and Matthews G (2005) Evaluation anxiety: Current theory and research. In: Elliot AJ and Dweck CS (eds) *Handbook of Competence and Motivation*. New York: Guilford Publications, pp.141–163.

Zeidner M and Schleyer EJ (1999) The big-fish–little-pond effect for academic self-concept, test anxiety, and school grades in gifted children. *Contemporary Educational Psychology* 24(4): 305–329.

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