Predictive Strengths of Basic Psychological Needs in Physical Education Among Hispanic Children: A Gender-Based Approach

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Abstract:

Purpose: Based on the self-determination theory, this study explored the predictive strengths and relative importance of basic psychological needs (BPNs; i.e., autonomy, competence, and relatedness) in physical education in physical, cognitive, and psychological outcomes among Hispanic boys and girls.

Methods: Fourth- and fifth-grade Hispanic children (N = 214; 110 boys and 104 girls) completed surveys measuring BPNs, effort in physical education, and general well-being and objective assessments of cardiorespiratory fitness and body mass index. Multiple regression analyses were performed on the three adaptive outcomes by gender to determine the relative importance of BPNs.

Results: The analyses revealed that (a) competence was the most important BPN in predicting effort and well-being among both boys and girls; (b) relatedness predicted only well-being among boys, but both effort and well-being among girls; and (c) autonomy did not predict any outcomes.

Conclusions: The findings highlight the importance of satisfying Hispanic children's competence and girls' relatedness in physical education.

Keywords: cardiorespiratory fitness | effort | elementary students | self-determination theory | unique variance | well-being

Article:

As one of the fastest-growing ethnic groups aged under 18 in the United States, Hispanic school-aged children represent 24.4% of the population and are estimated to increase to 33.5% by 2060 (Colby & Ortman, 2015). According to recent national data (Ogden et al., 2016), the obesity and extreme obesity rates of Hispanic children aged 6–11 years were the highest (25% and 9.3%, respectively) compared with those of other racial/ethnic groups. Research also showed that, when compared with White and African American children, respectively, Hispanic children were about

1.7 and 3 times more likely to spend excessive screen time viewing television, using computers, and/or playing sedentary video games, and they were 1.7 and 1.6 times less likely to be physically active (Fakhouri, Hughes, Brody, Kit, & Ogden, 2013). Because this population is vulnerable to the risk of health problems, more research is warranted to understand Hispanic children's physical and psychosocial outcomes and develop effective strategies to promote their health and wellness.

One of the main goals of school physical education (PE) is to promote children's physical, cognitive, and psychological development (Mitchell & Fisette, 2016). For instance, through PE participation, children learn to be physically healthy and fit, gain health-related knowledge, value physical activity, and perceive high self-esteem. However, children's intrinsic motivation and enjoyment in PE gradually decline with age, starting in the late elementary years, especially among girls. For instance, when studying 2,262 children aged 9–10 years over five time points during a 2-year period of PE participation, Cairney et al. (2012) found a decline in enjoyment among the girls with low perceived competence, whereas the levels of enjoyment remained constant among the boys with low perceived competence. This finding suggests that gender plays a role in children's development of perceived competence and motivation in PE. Furthermore, the researchers argue that PE is a gender-stereotyped setting, in which boys are favored and supported in performing physical activities, whereas girls have fewer opportunities to experience competent feedback from teachers and parents (Fredricks & Eccles, 2002). These gender stereotypes could influence boys and girls differently in terms of motivation and intention toward future participation in physical activity (Xiang, McBride, Lin, Gao, & Francis, 2018). Thus, gender should be considered when studying the associations between motivational factors and adaptive outcomes in PE (Taylor, Ntoumanis, Standage, & Spray, 2010; van Aart, Hartman, Elferink-Gemser, Mombarg, & Visscher, 2017). More empirical evidence in different psychosocial and motivational processes in PE across gender, especially among minority children, would inform PE teachers about practical strategies that can enhance boys' and girls' motivation more effectively.

Basic Psychological Needs

Self-determination theory (SDT; Deci & Ryan, 1985) is a prominent theory for examining psychosocial and motivational factors in PE. SDT proposes that the fulfillment of basic psychological needs (BPNs; i.e., autonomy, competence, and relatedness) is associated with more adaptive outcomes, including better physical and psychological well-being (Ryan & Deci, 2001). In the context of PE, some commonly studied adaptive outcomes include effort, concentration, persistence, and interest in PE (Taylor & Lonsdale, 2010; Xiang et al., 2018). In contrast to the adaptive outcomes that are derived from satisfaction of the BPNs, maladaptive outcomes, such as disengagement and boredom in PE, are attributed to frustration of the BPNs (Vansteenkiste & Ryan, 2013). According to Deci and Ryan (1985), the core BPN for healthy human functioning is autonomy, which refers to the need to regulate one's own behaviors volitionally, such as choosing activities to engage in during PE. Competence reflects the desire and expectation to be effective when performing tasks and the opportunities to demonstrate these capabilities. For instance, children can feel competent in PE if they accomplish exercises and perform them well. Relatedness is the feeling of being emotionally connected to and cared for by significant others. For example, children may feel related through group activities and interactions with their classmates in PE.

The positive associations between BPNs in PE and adaptive outcomes, including physical (e.g., physical activity), cognitive (i.e., effort and intention), and psychological (i.e., vitality) aspects, have been well supported (Standage, Gillison, Ntoumanis, & Treasure, 2012; Sun, Li, &

Shen, 2017). Regarding the predictive strengths of BPNs, competence has been shown to be a stronger predictor than autonomy and relatedness in predicting adaptive outcomes in middle school and high school PE, such as physical activity, effort, engagement, and vitality in PE (Curran & Standage, 2017; Taylor et al., 2010; Xiang et al., 2018). However, the literature to date has yet to clearly identify the relative importance of the three BPNs in adaptive outcomes in elementary PE settings, especially among Hispanic children. To our knowledge, only one published study examined BPNs among Hispanic adolescents, and it showed that competence was more important than autonomy and relatedness in predicting autonomous motivation in physical activity (Vierling, Standage, & Treasure, 2007). Furthermore, a dearth of research has investigated gender differences regarding the predictive strengths of BPNs (Standage et al., 2012; van Aart et al., 2017), and "whether SDT plays different roles in gender as related to students' psychomotor, cognitive, and affective learning in PE is unknown" (Sun et al., 2017, p. 288). Although Standage et al. (2012) found no gender differences in the predictive strengths of BPNs on the physical self-concept and health-related well-being of adolescents in the United Kingdom, the findings could be different for Hispanic children due to different cultures and school environments that place a lower priority on PE (Vierling et al., 2007).

Adaptive Outcomes in PE

School PE provides a primary avenue for children to enhance regular physical activity participation and physical fitness, prevent obesity, and promote psychosocial development for the "total child" (Le Masurier & Corbin, 2006). Accordingly, this study attempted to examine cardiorespiratory fitness, effort in PE, and general well-being as respective adaptive outcomes in terms of physical, cognitive, and psychological domains related to PE.

Cardiorespiratory fitness, a primary component of health-related physical fitness, is an important factor for reducing the risk of cardiovascular disease and metabolic syndromes. However, the nationwide FITNESSGRAM® assessment (The Cooper Institute, 2017) in the United States showed age-related declines in the achievement of a healthy fitness zone (HFZ) among children and adolescents. Specifically, the percentage of boys who reached the HFZ for cardiorespiratory fitness dropped gradually from about 60% of the population in fourth and fifth grades to about 40% in high school; the percentage of girls who reached the HFZ for cardiorespiratory fitness also dropped gradually from about 50% of the population in fourth and fifth grades to about 30% in high school (Bai et al., 2015). These statistics suggest that fourth and fifth grades may be an important period for promoting physically fit individuals. The positive effect of satisfying BPNs on children's physical activity participation and motor skills has been well established (Taylor et al., 2010; van Aart et al., 2017), whereas few researchers have investigated this effect on fitness outcomes (Xiang et al., 2018). Although perceived competence was found to be a positive predictor of cardiorespiratory fitness (Gu, Thomas, & Chen, 2017), how autonomy and relatedness contribute to boys' and girls' cardiorespiratory fitness has not been sufficiently studied. Thus, more research considering gender differences in these relationships is warranted.

Effort in PE is important within an educational setting as an indirect indicator that reflects the amount of physical and mental energy during learning (Taylor et al., 2010). Children who put forth effort in PE are more likely to achieve the goal of being physically active in daily life. Children aged 11–12 years are at a developmental stage that begins to recognize the differences between effort and ability (Nicholls, 1989); therefore, they are more aware of the amount of effort they put in certain tasks and make adjustment based on their performance evaluation. Whereas

previous studies showed that the three BPNs could positively predict effort in PE (Leptokaridou, Vlachopoulos, & Papaioannou, 2015), a dearth of them considered the role of gender in the prediction (Sun et al., 2017; Taylor & Lonsdale, 2010). Therefore, further evidence of gender differences in predicting effort in PE can inform strategies for promoting physical activity and health among both boys and girls.

As an important indicator of psychological development, general well-being refers to an individual's positive or negative feelings, life satisfaction, vitality, and physical and psychosocial functioning (Ryan & Deci, 2001). Specifically, children's perceived happiness, social support from family and friends, health conditions, and expectations of good things are considered indicators of their general well-being (Varni, Seid, & Kurtin, 1999). BPNs in PE are direct contributors of well-being (Curran & Standage, 2017; Standage et al., 2012). Specifically, competence and relatedness had positive effects on both physical activity and well-being of children from low-income families (Breslin et al., 2017). Recognizing the relative importance of BPNs in predicting well-being might be informative in structuring PE to promote health and wellness among children, especially Hispanic girls who experience elevated psychosocial concerns during puberty (Benjet & Hernández-Guzmán, 2002).

Body composition, commonly assessed with body mass index (BMI), is one of the most studied fitness components in children (Bai et al., 2015). Ample research has shown that BMI is negatively associated with adaptive physical and psychological outcomes, such as physical fitness and psychological well-being, in both elementary students and Hispanic children (Bai et al., 2015; Benjet & Hernández-Guzmán, 2002). Therefore, it would be reasonable to control for body composition in order to examine the unique contribution of BPNs to adaptive outcomes in this study. By investigating gender-specific motivational processes, this study could contribute to both the theoretical underpinning for the relative importance of BPNs in predicting various adaptive outcomes related to PE and the practical implications for PE teachers in supporting Hispanic boys' and girls' physical and psychological well-being accordingly. This research effort has the potential to further facilitate theory-based interventions in PE to enhance adaptive health outcomes and combat high obesity rates among Hispanic children.

The purpose of this study, therefore, was to investigate the predictive strengths of BPNs on adaptive outcomes in PE among Hispanic boys and girls, respectively. Specifically, this study sought to answer two research questions: (a) Which of the three BPNs would significantly predict cardiorespiratory fitness, effort in PE, and general well-being among Hispanic boys and girls after controlling for BMI? and (b) What was the relative importance of the three BPNs in predicting each adaptive outcome within gender and between genders?

Methods

Participants and Settings

The participants were 215 Hispanic children (Mage = 10.66 years, SD = 0.58 years; 111 boys and 104 girls) who attended fourth (n = 112) or fifth grade (n = 103) in a suburban school district in the southwestern United States. The four elementary schools recruited in this study were located in the same school district and considered to be bilingual schools; approximately 47% of the student body was comprised of Hispanic children, and 78% was comprised of students from low-income families with free- or reduced-lunch status.

The participants were enrolled in one of the two PE class sections in each school for approximately 45 min of class time every other day (i.e., two or three times per week). Each class was taught by two certified PE teachers with more than 5 years of teaching experience. The general instructional protocol included class attendance taken by the PE teachers as students arrived in the gym, followed by warm-up activities and games. The teachers typically organized the class by introducing motor skills via a direct-instruction approach at the beginning, offering practice opportunities for students during the middle of the class, and providing a lesson closure at the end of the class. During the data-collection period, all the participants took part in a variety of sports and physical activities by following the district's curriculum and teachers' directions.

Procedure

Upon approval of the study from the University of North Texas' Institutional Review Board, participants were recruited in accordance with the requirements of the institutional review board and the school district. The schools provided information for identifying the Hispanic children, who were invited to participate in this study. After receiving parental consents and student assents, data collection was conducted during three PE classes within 3 weeks between March and May 2015. Following the directions of the first author and research assistants who had completed two training sessions on data collection, the participants completed paper-and-pencil surveys measuring their BPNs, effort in PE, and general well-being, as well as a physical fitness test protocol assessing their height, weight, and cardiorespiratory fitness. To ensure that children of other races and ethnicities did not feel singled out, all of them participated in PE with teachers at the gym when the participants were called out to complete the survey with the researchers at the cafeteria, and every child participated in the fitness assessments.

Measures

Demographic information. The demographic variables, including grade level, date of birth, gender, and race/ethnicity, were provided by the school staff. Age was calculated manually, according to the participants' date of birth and the date of the first assessment.

Basic psychological needs in PE. The participants' perception of BPNs was assessed with three 7-point Likert scales ranging from 1 (strongly disagree) to 7 (strongly agree). Autonomy was assessed with the 6-item scale created by Standage, Duda, and Ntoumanis (2005) using the stem in my PE class. A sample item is I have some choice in what I want to do, and there was one reverse-scored item: I have to force myself to do the activities. Competence was assessed with the 5-item competence subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) using the same stem, in my PE class. A sample item is I think I am pretty good at PE, and there was one reverse-scored item: I cannot do PE very well. Relatedness was assessed with the 5-item acceptance subscale of the Need for Relatedness Scale (Richer & Vallerand, 1998), which was modified to the PE context with the stem With the other students in my PE class, I feel (Standage et al., 2005). A sample item is supported, and there were no reverse-scored items. All three measures were shown to be valid and reliable with psychometric evidence across countries and age groups, including elementary-school-aged children (Leptokaridou et al., 2015; Standage et al., 2005).

Cardiorespiratory fitness. The Progressive Aerobic Cardiovascular Endurance Run (PACER) test of the FITNESSGRAM® assessment was conducted to assess participants' cardiorespiratory fitness. The PACER test is a multistage 20-m (i.e., a lap) shuttle run test in which the participants followed a tape recorder for the running speed. The speed starts slowly and increases gradually each minute. The participants were encouraged to run for as long as possible before they began the test. Their fitness level was indicated by the number of laps completed, which was recorded when they failed to reach the end line on two occasions during their run or stopped due to fatigue. Based on the FITNESSGRAM® 10 standards accounting for age and gender (The Cooper Institute, 2017), the participants' cardiorespiratory fitness was classified as HFZ or needs improvement (NI).

Effort in PE. Effort in PE was assessed with the 4-item effort subscale of the Intrinsic Motivation Inventory (McAuley et al., 1989) in a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). A sample item is I put a lot of effort in when I play in this PE class, and there was one reverse-scored item: I don't try very hard in this PE class. Good validity and reliability were shown across countries and age groups, including elementary-school-aged children (Leptokaridou et al., 2015).

General well-being. Well-being was assessed with the 6-item General Well-Being Scale of the Pediatric Quality of Life Inventory™ (version 4.0; PedsQL™ 4.0; Varni et al., 1999) in a 5-point Likert scale. The response options were 0 (never), 1 (almost never), 2 (sometimes), 3 (often), and 4 (almost always), which were then linearly transformed to a 0–100 scale (0, 25, 50, 75, and 100) following the scoring procedure of the PedsQL™ 4.0. A sample item is I feel good about my health. The comprehensive validity and reliability evidence was summarized by Varni et al. (1999), indicating its appropriateness for both research use and clinical diagnosis.

Body composition. The researchers measured the participants' objective height and weight using the Health-O-Meter 500KL Digital Scale (Boca Raton, FL), and then used the standard formula to calculate their BMI (weight (kg)/[height (m)]2) as the indicator of body composition. Based on the FITNESSGRAM® 10 standards accounting for age and gender (The Cooper Institute, 2017), the participants' BMI was classified as very lean, HFZ, NI, or NI-health risk.

Data analysis

All data were checked for missing and invalid values, outliers, and normality; univariate and multivariate outliers were defined as a standardized score ($|z|$) larger than 3 and a Mahalanobis D2 larger than the critical value ($p < .001$), respectively (Tabachnick & Fidell, 2007). There were less than 5% of missing values, so an expectation–maximization algorithm was used to impute missing data (Tabachnick & Fidell, 2007). Descriptive statistics and correlation coefficients were then computed for all study variables. The criteria of Pearson $r = .10$, .30, and .50 were used to indicate weak, moderate, and strong correlations, respectively (Cohen, 1992). To determine the appropriateness of the data for conducting regression analyses, assumptions of linear relationships and homoscedasticity were examined through the visual inspection of scatterplots of residuals from the regression models against each predictor and predicted outcome variable ($\hat{Y}$); the normality of residuals was tested using normal Q–Q plots; and multicollinearity diagnostics were examined.

To examine gender differences, three separate hierarchical regression analyses were performed on cardiorespiratory fitness, effort, and well-being for boys and girls, respectively. The significance level was Bonferroni corrected and set at $\alpha = .025$ (.05/2), because each dependent variable was regressed on the same predictors twice for gender-specific analyses (Veazie, 2006). As previously mentioned, BMI is a significant correlate of adaptive outcomes (Bai et al., 2015; Benjet & Hernández-Guzmán, 2002), so it would be controlled in the regression analyses. Autonomy, competence, and relatedness were entered in the second step as predictors to examine their significance in the corresponding regression models. After controlling for BMI, the variance explained by the three BPNs in each outcome was determined using the squared coefficient of multiple regression (R2). The values of .01, .09, and .25 represent a small, medium, and large variance, respectively (Cohen, 1992). Furthermore, post hoc power analyses were conducted using G*Power 3.1 to examine whether the regression analyses with three BPN predictors achieved the desired power of .80 for detecting a statistical significance of $\alpha = .025$ (Cohen, 1992).

To investigate the relative importance of autonomy, competence, and relatedness in each regression model, squared semipartial correlations (sr^2), and squared structure coefficients (r^2_s) were computed for interpretation beyond the beta weights (β).[1] These computations were important, because the sole interpretation of βs would likely yield biased results caused by intercorrelations between the BPNs (Courville & Thompson, 2001; Nathans, Oswald, & Nimon, 2012; Yeatts, Barton, Henson, & Martin, 2017). An examination of sr^2 and r^2_s provides additional benefits and helps to determine the impact of both unique and shared variance among predictors (Nathans et al., 2012); sr^2 indicates how much unique variance a predictor contributes to a regression model and denotes a total effect, whereas r^2_s reveals how much variance a predictor shares with $\hat{Y}$ and denotes a direct effect.[2] The relative importance of significant predictors was determined by examining the magnitude of both β and r^2_s using Courville and Thompson's (2001) approach:

> When interpreting regression results, once noteworthy effects have been detected it may be best to consult the full system of results, just as we routinely would in applications of other members of the general linear model analytic family. The two sets of coefficients—β weights and structure coefficients—provide us with a more insightful stereoscopic view of dynamics within our data. (p. 245)

Results

Descriptive statistics and correlations

All study variables were normally distributed (|skewness| and |kurtosis| < 2). Whereas no univariate outliers were observed (|z| < 3), one multivariate outlier existed (Mahalanobis D2 = 21.01; p < .001), which influenced the results of the regression analyses. Therefore, this case was deleted, resulting in a final sample of 214 participants (110 boys and 104 girls). The BMI distribution in the final sample was very lean (n = 7), HFZ (n = 103), NI (n = 41), and NI-health risk (n = 63); the distribution of cardiorespiratory fitness was HFZ (n = 104) and NI (n = 110). These ratios were comparable with the data pertaining to national health epidemics in that about half of Hispanic children were overweight or obese and had low levels of cardiorespiratory fitness (National Physical Activity Plan Alliance, 2016).

Table 1. Descriptive Statistics and Bivariate Correlations Among Study Variables by Gender (N = 214)

	Range	M	SD	1.	2.	3.	4.	5.	6.	7.
1. **Autonomy**	1–7	4.38	1.40	**.80**	.62***	.70***	.23*	.54***	.61***	−.23*
2. **Competence**	1–7	5.09	1.50	.61***	**.89**	.65***	.32**	.61***	.66***	−.39**
3. **Relatedness**	1–7	4.97	1.42	.54***	.65***	**.82**	.04	.61***	.64***	−.09
4. **PACER laps**	2–45	19.68	8.59	.08	.11	.04	—	.13	.18	−.46***
5. **Efforts**	1–7	5.54	1.49	.35***	.64***	.49***	−.02	**.86**	.43***	−.11
6. **Well-being**	0–100	77.72	17.52	.27**	.50***	.47***	−.03	.34***	**.83**	−.23*
7. **BMI**	13.6–36.0	21.46	5.22	.12	.01	.10	−.30**	−.08	−.09	—

Note. Correlations for boys (n = 110) are below the diagonal; correlations for girls (n = 104) are above the diagonal; Cronbach's alphas are in bold on the diagonal. BMI = body mass index; PACER = Progressive Aerobic Cardiovascular Endurance Run.
*p < .05. **p < .01. ***p < .001.

Table 2. Hierarchical Regression Analyses Predicting PACER Laps, Effort, and Well-Being Among Boys (N = 110) and Girls (N = 104)

	Boys					Girls				
Predictors	ΔR^2	β	t	sr^2	r2s	ΔR^2	β	t	sr^2	r2s
Dependent variable: PACER laps										
Step 1	.09**					.21**				
Step 2	.02					.06				
BMI		−.31	−3.32**	.09	.84		−.34	−3.53**	.09	.65
Autonomy		.09	0.74	.00	.07		.20	1.60	.02	.17
Competence		−.07	0.53	.00	.10		.26	1.99	.03	.31
Relatedness		−.02	−0.18	.00	.01		−.31	−2.26	.04	.01
Dependent variable: Effort										
Step 1	.01					.01				
Step 2	.42**					.45**				
BMI		−.09	−1.22	.01	.11		.10	1.17	.01	.09
Autonomy		−.08	−0.87	.00	.29		.13	1.21	.01	.66
Competence		.58	5.46**	.16	.95		.39	3.56**	.07	.88
Relatedness		.16	1.65	.01	.56		.27	2.36*	.03	.79
Dependent variable: Well-being										
Step 1	.01					.05*				
Step 2	.30**					.48**				
BMI		−.11	−1.29	.01	.02		−.01	−0.18	.00	.05
Autonomy		−.11	−1.08	.01	.23		.20	1.99	.02	.69
Competence		.39	3.31**	.07	.82		.36	3.53**	.06	.80
Relatedness		.28	2.59*	.04	.71		.26	2.34*	.03	.82

Note. BMI was entered in Step 1 as a control variable for a simple regression model. sr2 = squared semipartial correlation (i.e., unique variance); r^2_s = squared structure coefficient (i.e., shared variance with the predicted scores of dependent variable); BMI = body mass index; PACER = Progressive Aerobic Cardiovascular Endurance Run.
*p < .025. **p < .001.

The results for descriptive statistics and correlation coefficients are presented in Table 1. The perceptions of the participants toward PE were relatively positive, evidenced by higher than average levels (Ms > 4) of BPNs and effort in PE. With regard to bivariate relationships, the three BPNs were (a) positively and strongly correlated with one another among both boys and girls; (b) positively and moderately/strongly correlated with effort and well-being, although these relationships were stronger among girls than boys; and (c) not correlated with PACER laps among boys, whereas autonomy and competence were positively and weakly/moderately correlated with PACER laps among girls. In addition, BMI was negatively and moderately correlated with PACER laps among both boys and girls; BMI was also negatively and weakly/moderately correlated with autonomy, competence, and well-being among girls, but not boys.

All assumptions for correct specification of the regression models were met, and no multicollinearity was observed with the diagnostics of variance inflation factors (<10), tolerance (>.10), and condition numbers ($\kappa < 30$). It is important to note that, when only BMI was entered in Step 1 as a simple regression model, the significance level of the model and values of R and β were the same as the correlational analyses. Therefore, only the overall model and prediction in Step 2 were interpreted in the following sections and in Table 2.

Regression analyses

Three BPNs did not explain significant amount of variance in the overall model of PACER laps among boys ($\Delta R2 = .017$, p = .58) or girls ($\Delta R2 = .061$, p < .05), although the corresponding models were significant, $F(4, 105) = 3.17$, p < .05 and $F(4, 99) = 9.26$, p < .001, due to the contribution of BMI. As a control variable, BMI was the only significant variable in predicting PACER laps among both boys ($\beta = -.31$) and girls ($\beta = -.34$).

In the overall model of effort in PE among boys and girls, $F(4, 105) = 10.78$ and $F(4, 99) = 21.87$, p < .001, respectively, three BPNs significantly explained a large amount of variance ($\Delta R2 = .42$ and .45). Competence was the only significant predictor among boys, contributing to 16% of the unique variance in the regression model and sharing 95% of the variance with $Y^\wedge$. Both competence and relatedness were significant predictors among girls, contributing to 16% and 7% of the unique variance in the regression model and sharing 88% and 79% of the variance with $Y^\wedge$, respectively. Comparing the regression models by gender, competence was more important for boys than girls, while relatedness was more important for girls than boys in predicting effort; BMI did not predict effort in this study (p > .05). The post hoc power analyses showed sufficient powers of .970 and .988 for boys' and girls' models, respectively.

Three BPNs significantly explained a large amount of variance ($\Delta R2 = .30$ and .48, respectively) in the overall model of well-being among boys and girls, respectively, $F(4, 105) = 11.70$ and $F(4, 99) = 28.12$, p < .001. Both competence and relatedness were significant predictors among boys and girls, contributing to (a) 7% and 4% of the unique variance in the boys' regression model and sharing 82% and 71% of the variance with $Y^\wedge$, respectively, and (b) 6% and 3% of the unique variance in the girls' regression model and sharing 80% and 82% of the variance with $Y^\wedge$, respectively. Comparing the regression models between boys and girls, both competence and relatedness were similarly important, based on the magnitude of β and r^2_s, with competence slightly more important than relatedness in predicting well-being; BMI did not predict well-being in this study (p > .05). The post hoc power analyses showed a sufficient power of .998 for the girls' model, but a lower-than-desired power of .673 in the boys' model. Given that both competence

and relatedness were significant predictors in the boys' model, the risk of Type II errors might not have influenced this regression model as much (Cohen, 1992).

Discussion

The purpose of this study was to examine the predictive strengths of BPNs on adaptive outcomes in PE within gender and between genders in a sample of Hispanic elementary-school-aged children. The main study findings were in support of previous SDT-based PE literature in other populations, although this study revealed some unique differences in the contribution of BPNs between genders. These unique differences were evidenced by examining the unique variance and structure coefficients in the corresponding regression models. Figure 1 summarizes the predictive strengths of BPNs to aid in the discussion.
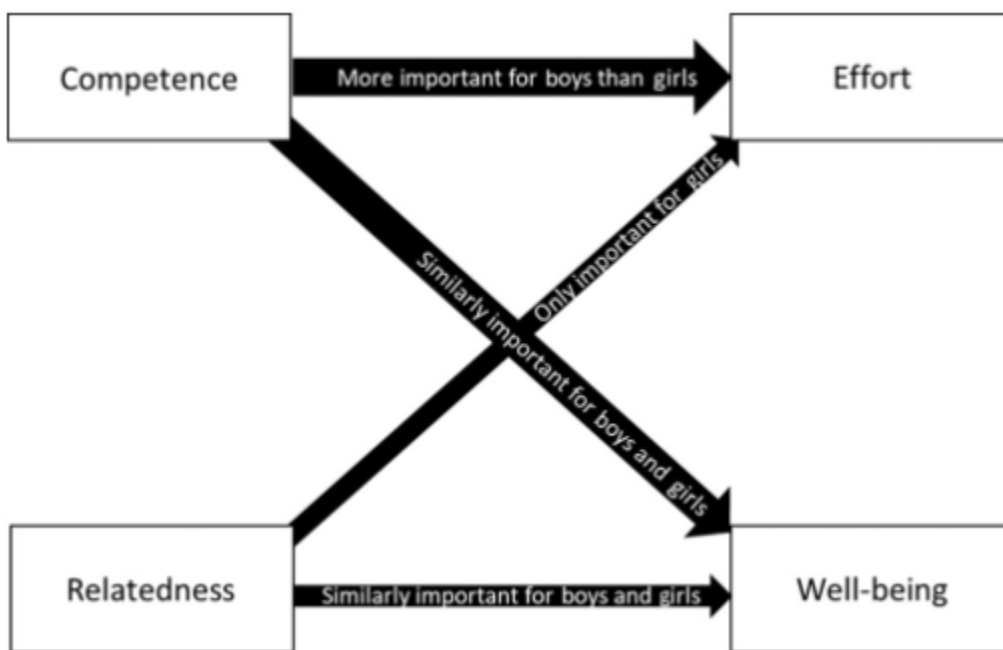

Figure 1. Relative importance of basic psychological needs in physical education on adaptive outcomes among Hispanic boys and girls.
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With regard to the physical outcome, none of the BPNs emerged as significant predictors, whereas BMI explained a medium-to-large variance as a control variable in cardiorespiratory fitness among both boys and girls. This result is consistent with previous research that showed psychological factors were not as strong as physical factors in predicting physical outcomes among Hispanic students (Vierling et al., 2007). Nevertheless, an examination of the bivariate relationships and structure coefficients suggests that competence was moderately related to girls' cardiorespiratory fitness. This finding implies the potential contribution of competence to promoting the physical fitness of Hispanic girls. In practice, PE teachers may provide more opportunities for Hispanic girls to enhance their competence beliefs toward health-related fitness through participation in various physical activities. In addition, teachers may rotate girls with lower skill levels in small

groups in order to reduce their self-consciousness in performing physical activities and enhance their perceived competence for fitness improvement.

Regarding the cognitive outcome, BPNs explained a large variance in effort in PE among both boys and girls. Both the unique variance and the structure coefficient showed that competence was the most important BPN for both genders, albeit more important for boys than girls. The central role of competence in effort is consistent with previous research findings among elementary- and middle-school-aged children in various countries (Leptokaridou et al., 2015; Ntoumanis, 2001; Taylor & Lonsdale, 2010). Relatedness was a significant predictor among girls only. These results suggest that, to assist Hispanic children in putting forth effort in PE, competence may be more important for boys, who place more value on sports and PE than girls do (Fredricks & Eccles, 2002), whereas relatedness may be more important for girls, who place more value on social interaction and recognition in PE than boys do (Garn, McCaughtry, Shen, Martin, & Fahlman, 2011). Furthermore, fourth- and fifth-grade Hispanic girls rated athletic appearance and competence lower, but encouragement from friends higher than other racial/ethnic and gender groups (Anderson, Mâsse, Zhang, Coleman, & Chang, 2011); thus, relatedness might play a relatively more important role in adaptive outcomes among Hispanic girls than others.

Concerning the psychological outcome, BPNs explained a large variance in general well-being among both boys and girls. Both competence and relatedness were significant predictors among both boys and girls. In line with previous research evidence (Standage et al., 2012), autonomy in PE was not significant in predicting psychological outcomes. An examination of the unique variance and structure coefficients suggested that competence was the most important BPN in predicting well-being, with similar magnitudes between genders.

Although autonomy was not a significant predictor of any adaptive outcomes among boys and girls in this study, its contribution in the regression analyses was worthy of investigation. Previous PE studies have attributed the nonsignificant role of autonomy to an incomprehensive assessment of autonomy that was based only on the perceived choices in PE (Ntoumanis, 2001; Taylor & Lonsdale, 2010), which might also explain the nonsignificant role of autonomy in this study. Furthermore, Reeve, Nix, and Hamm (2003) conducted three studies in an educational setting, which revealed that the internal locus and volition components of autonomy were more important than perceived choices in predicting self-determination. Shen (2015) argued that PE curricula often include traditional physical activities preferred by boys; thus, offering activity choices for girls, such as dance and yoga, is crucial for improving girls' motivation in PE as well as enhancing their health values and well-being. This perceived choice may be especially important for improving Hispanic girls' effort in PE and well-being due to their relatively low physical activity participation, high sedentary behavior (Fakhouri et al., 2013), and low perceived importance of physical activity (Anderson et al., 2011) when compared with girls of other racial/ethnic groups. Thus, in addition to satisfying Hispanic girls' competence and relatedness needs, PE teachers should provide them with appropriate and culturally relevant activity choices (Azzarito & Solmon, 2009), which may help the girls put forth effort in PE and experience greater well-being, including perceived physical health, happiness, and social support.

This study demonstrates several unique strengths and contributions to the literature. First, the results of this study provide new understandings of the different roles of the three BPNs in predicting various adaptive outcomes related to PE. Our investigation on only Hispanic children offers unique evidence of this population and also encourages future comparisons across races/ethnicities and cultures that little research has examined. Second, this study included objective physical measures of BMI and the cardiorespiratory fitness assessment, which added

internal validity to the findings as compared with research using only self-report measures. In addition, this study used a comprehensive approach to investigate the predictive strengths and relative importance of BPNs based on the unique variance and structure coefficients in regression models instead of solely using significant R2 change and beta weights for interpretation of the findings (Courville & Thompson, 2001; Nathans et al., 2012). It is recommended that future research continue to adopt this approach to examine the relative importance of predictors and group comparisons that would otherwise not be revealed (Yeatts et al., 2017).

There are limitations that need to be addressed for future research. First, this study used a cross-sectional research design in which causality could not be developed. Future research should use an experimental or a longitudinal research design to examine how changes in BPNs may predict physical, cognitive, and psychological outcomes across genders (e.g., Taylor et al., 2010). Second, due to a relatively small sample size for hierarchical linear modeling, this study only investigated the student-level effects, but not the class- or school-level effects, which limited the generalization of the findings. Future investigations should recruit a larger sample size to examine how the class- or school-level BPNs (e.g., Taylor & Lonsdale, 2010) may contribute to boys' and girls' adaptive outcomes differently. Third, autonomy was measured mostly based on perceived choices in this study, which might have contributed to its nonsignificance in predicting adaptive outcomes. Future studies should further assess the perceived locus of causality and volition aspects of autonomy in addition to perceived choices using a new validated measure in PE similar to those in other educational settings (Reeve et al., 2003). Finally, studying Hispanic children with a consideration of different sociodemographic factors, including family background, country of birth, and English- and Spanish-language proficiency, is warranted, as acculturation affects leisure-time physical activity and obesity among Hispanic adolescents (Liu, Probst, Harun, Bennett, & Torres, 2009).

Taking the study findings together, elementary PE teachers who teach Hispanic children should prioritize satisfaction of their competence to enhance their adaptive outcomes in PE (Cairney et al., 2012). For instance, teachers may design developmentally appropriate tasks with ample practice opportunities, as well as provide specific positive feedback, to enhance Hispanic children's perceived competence. Then, PE teachers should emphasize satisfaction of Hispanic girls' relatedness in PE by implementing more group activities that encourage cooperation, respect of diverse abilities, and acceptance among students, as well as support the girls' autonomy by offering meaningful activity choices and allowing students to make decisions about the degree of participation in various activities. Although satisfying Hispanic boys' relatedness and autonomy is also important from the theoretical standpoint (Deci & Ryan, 1985), focusing on satisfaction of competence may be more important in facilitating adaptive outcomes among Hispanic boys.

Conclusions

As the initial research effort within the context of PE that focuses on Hispanic children, a vulnerable population with more health issues than their counterparts in the United States, the findings of this study add empirical evidence to the current PE literature and knowledge for promoting adaptive outcomes among Hispanic boys and girls. The results of this study are consistent with previous research that highlights the central role of competence within the context of PE (Ntoumanis, 2001; Taylor & Lonsdale, 2010; Taylor et al., 2010). Contrary to previous studies conducted in Europe (Standage et al., 2012; van Aart et al., 2017), only small gender differences were found in the roles of BPNs in this study: relatedness had stronger predictive

strengths in adaptive outcomes among Hispanic girls than boys, in general. Thus, gender may interact with culture and race/ethnicity to influence the role of BPNs in adaptive outcomes related to PE. Further investigations are warranted to help us better understand how to develop healthy children across gender and race/ethnicity and optimize their physical, cognitive, and psychological outcomes.

Notes

1. Whereas sr^2 can be computed through regression analysis in SPSS, r^2_s has to be computed manually (see Courville & Thompson, 2001; Yeatts et al., 2017).
2. $\hat{Y}$ epresents the predicted dependent variable score in a regression model (see Courville & Thompson, 2001).

References

Anderson, C.B., Mâsse, L.C., Zhang, H., Coleman, K.J., & Chang, S. (2011). Ethnic, gender, and BMI differences in athletic identity in children and adolescents. Journal of Physical Activity & Health, 8, 200–209. PubMed ID: 21415447 doi:10.1123/jpah.8.2.200

Azzarito, L., & Solmon, M. (2009). An investigation of students' embodied discourses in physical education: A gender project. Journal of Teaching in Physical Education, 28, 173–191. doi:10.1123/jtpe.28.2.173

Bai, Y., Saint-Maurice, P.F., Welk, G.J., Allums-Featherston, K., Candelaria, N., & Anderson, K. (2015). Prevalence of youth fitness in the United States: Baseline results from the NFL PLAY 60 FITNESSGRAM partnership project. The Journal of Pediatrics, 167, 662–668. PubMed ID: 26188802 doi:10.1016/j.jpeds.2015.05.035

Benjet, C., & Hernández-Guzmán, L. (2002). A short-term longitudinal study of pubertal change, gender, and psychological well-being of Mexican early adolescents. Journal of Youth and Adolescence, 31, 429–442. doi:10.1023/A:1020259019866

Breslin, G., Shannon, S., Fitzpatrick, B., Hanna, D., Belton, S., & Brennan, D. (2017). Physical activity, well-being and needs satisfaction in eight and nine-year-old children from areas of socio-economic disadvantage. Child Care in Practice, 23, 275–291. doi:10.1080/13575279.2017.1299108

Cairney, J., Kwan, M.Y., Velduizen, S., Hay, J., Bray, S.R., & Faught, B.E. (2012). Gender, perceived competence and the enjoyment of physical education in children: A longitudinal examination. International Journal of Behavioral Nutrition and Physical Activity, 9, 26–33. PubMed ID: 22394618 doi:10.1186/1479-5868-9-26

Cohen, J. (1992). A power primer. Psychological Bulletin, 112, 155–159. PubMed ID: 19565683 doi:10.1037/0033-2909.112.1.155

Colby, S.L., & Ortman, J.M. (2015). Projections of the size and composition of the U.S. population: 2014 to 2060. Washington, DC: U.S. Census Bureau. Retrieved from http://www.census.gov/content/dam/Census/library/publications/2015/demo/p25-1143.pdf

Courville, T., & Thompson, B. (2001). Use of structure coefficients in published multiple regression articles: β is not enough. Educational and Psychological Measurement, 61, 229–248. doi:10.1177/0013164401612006

Curran, T., & Standage, M. (2017). Psychological needs and the quality of student engagement in physical education: Teachers as key facilitators. Journal of Teaching in Physical Education, 36, 262–276. doi:10.1123/jtpe.2017-0065

Deci, E.L., & Ryan, R.M. (1985). Intrinsic motivation and self-determination in human behavior. New York, NY: Plenum Press.

Fakhouri, T.H.I., Hughes, J.P., Brody, D.J., Kit, B.K., & Ogden, C.L. (2013). Physical activity and screen-time viewing among elementary school-aged children in the United States from 2009 to 2010. JAMA Pediatrics, 167, 223–229. PubMed ID: 23303439 doi:10.1001/2013.jamapediatrics.122

Fredricks, J.A., & Eccles, J.S. (2002). Children's competence and value beliefs from childhood through adolescence: Growth trajectories in two male-sex-typed domains. Developmental Psychology, 38, 519–533. PubMed ID: 12090482 doi:10.1037/0012-1649.38.4.519

Garn, A.C., McCaughtry, N., Shen, B., Martin, J.J., & Fahlman, M. (2011). Social goals in urban physical education: Relationships with effort and disruptive behavior. Journal of Teaching in Physical Education, 30, 410–423. doi:10.1123/jtpe.30.4.410

Gu, X., Thomas, K.T., & Chen, Y.-L. (2017). The role of perceived and actual motor competency on children's physical activity and cardiorespiratory fitness during middle childhood. Journal of Teaching in Physical Education, 36, 388–397. doi:10.1123/jtpe.2016-0192

Le Masurier, G., & Corbin, C.B. (2006). Top 10 reasons for quality physical education. Journal of Physical Education, Recreation & Dance, 77, 44–53. doi:10.1080/07303084.2006.10597894

Leptokaridou, E.T., Vlachopoulos, S.P., & Papaioannou, A.G. (2015). Associations of autonomy, competence, and relatedness with enjoyment and effort in elementary school physical education: The mediating role of self-determined motivation. Hellenic Journal of Psychology, 12, 105–128. doi:10.1037/a0014241

Liu, J., Probst, J.C., Harun, N., Bennett, K.J., & Torres, M.E. (2009). Acculturation, physical activity, and obesity among Hispanic adolescents. Ethnicity & Health, 14, 509–525. PubMed ID: 19404878 doi:10.1080/13557850902890209

McAuley, E., Duncan, T., & Tammen, V.V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport setting: A confirmatory factor analysis. Research Quarterly for Exercise and Sport, 60, 48–58. PubMed ID: 2489825 doi:10.1080/02701367.1989.10607413

Mitchell, S., & Fisette, J. (2016). The essentials of teaching physical education: Curriculum, instruction, and assessment. Champaign, IL: Human Kinetics.

Nathans, L.L., Oswald, F.L., & Nimon, K. (2012). Interpreting multiple linear regression: A guidebook of variable importance. Practical Assessment, Research & Evaluation, 17, 1–19.

National Physical Activity Plan Alliance. (2016). The 2016 U.S. report card on physical activity for children and youth. Retrieved from http://www.physicalactivityplan.org/reportcard/2016FINAL_USReportCard.pdf

Nicholls, J.G. (1989). The competitive ethos and democratic education. Cambridge, MA: Harvard University Press.

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. The British Journal of Educational Psychology, 71, 225–242. PubMed ID: 11449934 doi:10.1348/000709901158497

Ogden, C.L., Carroll, M.D., Lawman, H.G., Fryar, C.D., Kruszon-Moran, D., Kit, B.K., & Flegal, K.M. (2016). Trends in obesity prevalence among children and adolescents in the United States, 1988–1994 through 2013–2014. JAMA, 315, 2292–2299. PubMed ID: 27272581 doi:10.1001/jama.2016.6361

Reeve, J., Nix, G., & Hamm, D. (2003). Testing models of the experience of self-determination in intrinsic motivation and the conundrum of choice. Journal of Educational Psychology, 95, 375–392. doi:10.1037/0022-0663.95.2.375

Richer, S.F., & Vallerand, R.J. (1998). Construction et validation de l'Échelle du sentiment d'appartenance sociale. Revue Européenne de Psychologie Appliquée, 48, 129–137.

Ryan, R.M., & Deci, E.L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. Annual Review of Psychology, 52, 141–166. doi:10.1146/annurev.psych.52.1.141

Shen, B. (2015). Gender differences in the relationship between teacher autonomy support and amotivation in physical education. Sex Roles, 72, 163–172. doi:10.1007/s11199-015-0448-2

Standage, M., Duda, J.L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. The British Journal of Educational Psychology, 75, 411–433. PubMed ID: 16238874 doi:10.1348/000709904X22359

Standage, M., Gillison, F.B., Ntoumanis, N., & Treasure, D.C. (2012). Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation of motivation across school physical education and exercise settings. Journal of Sport & Exercise Psychology, 34, 37–60. PubMed ID: 22356882 doi:10.1123/jsep.34.1.37

Sun, H., Li, W., & Shen, B. (2017). Learning in physical education: A self-determination theory perspective. Journal of Teaching in Physical Education, 36, 277–291. doi:10.1123/jtpe.2017-0067

Tabachnick, B.G., & Fidell, L.S. (2007). Using multivariate statistics (5th ed.). Boston, MA: Pearson.

Taylor, I.M., & Lonsdale, C. (2010). Cultural differences in the relationships among autonomy support, psychological need satisfaction, subjective vitality, and effort in British and Chinese physical education. Journal of Sport & Exercise Psychology, 32, 655–673. PubMed ID: 20980709 doi:10.1123/jsep.32.5.655

Taylor, I.M., Ntoumanis, N., Standage, M., & Spray, C.M. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: A multilevel linear growth analysis. Journal of Sport & Exercise Psychology, 32, 99–120. PubMed ID: 20167954 doi:10.1123/jsep.32.1.99

The Cooper Institute. (2017). FitnessGram administration manual: The journey to MyHealthyZone (5th ed.). Champaign, IL: Human Kinetics.

van Aart, I., Hartman, E., Elferink-Gemser, M., Mombarg, R., & Visscher, C. (2017). Relations among basic psychological needs, PE-motivation and fundamental movement skills in 9–12-year-old boys and girls in physical education. Physical Education and Sport Pedagogy, 22, 15–34. doi:10.1080/17408989.2015.1112776

Vansteenkiste, M., & Ryan, R.M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. Journal of Psychotherapy Integration, 23, 263–280. doi:10.1037/a0032359

Varni, J.W., Seid, M., & Kurtin, P.S. (1999). Pediatric health-related quality of life measurement technology: A guide for health care decision makers. Journal of Clinical Outcomes Management, 6(4), 33–40.

Veazie, P.J. (2006). When to combine hypotheses and adjust for multiple tests. Health Services Research, 41, 804–818. PubMed ID: 16704513 doi:10.1111/j.1475-6773.2006.00512.x

Vierling, K.K., Standage, M., & Treasure, D.C. (2007). Predicting attitudes and physical activity in an "at-risk" minority youth sample: A test of self-determination theory. Psychology of Sport and Exercise, 8, 795–817. doi:10.1016/j.psychsport.2006.12.006

Xiang, P., McBride, R.E., Lin, S., Gao, Z., & Francis, X. (2018). Students' gender stereotypes about running in schools. The Journal of Experimental Education, 86, 233–246. doi:10.1080/00220973.2016.1277335

Yeatts, P.E., Barton, M., Henson, R.K., & Martin, S.B. (2017). The use of structure coefficients to address multicollinearity in sport and exercise science. Measurement in Physical Education and Exercise Science, 21, 83–91. doi:10.1080/1091367X.2016.1259162