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ARTICLE

Exploring the Role of Physical Education Teachers' Domain-Specific Innovativeness, Educational Background, and Perceived School Support in CSPAP Adoption

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Purpose: A comprehensive school physical activity program (CSPAP) is designed to help school-aged youth meet physical activity guidelines as well as develop the knowledge, skills, and dispositions that foster meaningful lifelong physical activity participation. In this study, we employed a "diffusion of innovations theory" perspective to examine the adoption of CSPAPs in relation to physical education teachers' domain-specific innovativeness, educational background, demographics, and perceived school support. **Methods**: Physical education teachers ($N = 407$) responded to an electronic survey with validated measures for each of the above-mentioned variables. **Results**: Latent profile analysis classified teachers into three domain-specific innovativeness levels (high, average, and low). CSPAP-related professional training, knowledge, and perceived school support were found to be significant factors in domain-specific innovativeness and CSPAP adoption. **Discussion/Conclusion**: This study provides novel evidence to inform professional development initiatives so that they can be tailored to physical education teachers who may be less likely to adopt a CSPAP.

Keywords*:* diffusion of innovations theory, latent profile analysis, new program adoption, whole-of-school approach

The comprehensive school physical activity program (CSPAP) model was introduced in a position statement by the National Association for Sport and Physical Education (NASPE, 2008, now the Society of Health and Physical Educators [SHAPE] America). A CSPAP has been viewed as a coordinated, "whole-of-school approach" (Institute of Medicine [IOM], 2013) to achieve two major goals: first, to educate youth with the knowledge, skills, and confidence to engage in a lifetime of meaningful participation in physical activity (PA), and, second, to ensure youth meet the national guideline of at least 60 min of mostly moderate to vigorous PA each day (National Association for Sport and Physical Education, 2008; Society of Health and Physical Educators (SHAPE) America, 2015).

Comprehensive school physical activity programs are usually conceptualized as multicomponent programs that include five components: (a) physical education (e.g., standards-based instruction in PA knowledge and skills, assessment of student learning), (b) PA during school (e.g., within regular classrooms, at recess), (c) PA before and after school (e.g., in clubs/intramurals, via active transportation to/from school), (d) staff involvement (e.g., promotion of youth PA by classroom teachers, staff wellness programming), and (e) family and community engagement (e.g., active homework involving other family members, joint use of facility agreements between schools and other community organizations; Society of Health and Physical Educators (SHAPE) America, 2015). However, this singular conceptualization of a CSPAP is inconsistent with research that suggests schools may identify myriad ways to promote PA that include, but are not limited to, the number of PA opportunities provided (Beets et al., 2016). In their extensive review of observational and experimental studies, Beets et al. (2016) demonstrate that expanding (replacing low active/sedentary time with PA time), extending (lengthening currently allocated time for PA), and/or enhancing (modifying existing PA opportunities to increase PA engagement) opportunities for PA can serve as effective mechanisms for increasing PA in children and adolescents (refer Beets et al., 2016 for details of the specific studies reviewed). Moreover, "ground truthing" research aimed at generating depictions of CSPAPs in the real world is limited, and, as a result, little is known about the configuration or makeup of existing CSPAPs. For the purposes of this study, therefore, a CSPAP was conceptualized as any variety or combination of program components a school uses to achieve both of the aforementioned goals of a CSPAP. From this perspective, the notion of comprehensiveness applies more to comprehensively

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meeting program goals than it does to employing all five components of a model that may serve as a useful heuristic but not as an algorithm for contextually-driven CSPAP development and implementation.

Multicomponent conceptualizations of health promotion through schools trace back to the 1980s, well before the CSPAP model was introduced (Allensworth, 1997; Allensworth & Kolbe, 1987; Kelder, Goc Karp, Scruggs, & Brown, 2014). However, the CSPAP model has emerged as the prevailing representation for coordinated approaches to school-based PA promotion in the United States. Although the CSPAP model clearly embodies elements of its lineage within the broader context of comprehensive and coordinated school health, it uniquely articulates both educational (i.e., physical literacy) and behavioral (i.e., daily engagement in PA) goals of school-based PA promotion and distills a core set of components that intuitively deserve particular attention when planning and implementing a program to meet these goals. From this perspective, a CSPAP can be viewed as an innovation for marshaling the resources deemed necessary to ensure all youth receive the education and support they need to enjoy PA and be physically active both now and in the future.

Even though the CSPAP model was first introduced a decade ago, little research has examined the extent to which CSPAPs have been adopted in the United States. In 2011, the American Alliance for Health, Physical Education, Recreation and Dance (now SHAPE America) conducted a survey with a convenience sample of schools spanning multiple states (American Alliance for Health, Physical Education, Recreation and Dance, 2011). The survey focused on the extent to which schools or school districts were providing each possible component of the model to maximize every student's access to quality physical education and PA opportunities. The results, informed mostly by responses from physical education teachers, indicated that less than one sixth of schools (16% of elementary schools, 13% of middle schools, and 6% of high schools) provided a CSPAP. Recommendations for implementing CSPAPs place emphasis on the role of physical education teachers as potential program leaders (Beighle, Erwin, Castelli, & Ernst, 2009; Carson, 2012; Carson, Castelli, Beighle, & Erwin, 2014; Heidorn & Centeio, 2012). It is generally expected, therefore, that physical education teachers would play a primary role in the adoption of CSPAPs. However, investigation into the factors that may influence physical education teachers' CSPAP adoption has been limited.

Diffusion of Innovations Theory: Overview of the Adoption Process

One perspective that could provide useful information about why some physical education teachers may be more inclined to adopt a CSPAP than others is diffusion of innovations theory (DOIT). Rogers' (1995, 2003) seminal work on DOIT addresses both the adoption and diffusion of innovations within organizations. With respect to the adoption process, the theory articulates five stages: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation. Much DOIT research focuses on the decision stage, during which potential adopters evaluate an innovation in terms of its perceived attributes. Specifically, potential adopters evaluate the innovation's *relative advantage* (the advantages it possesses compared with current programs/practices), *compatibility* (how closely aligned the philosophy and competencies are of the potential adopter to the nature and requirements of the innovation), *complexity* (how difficult it would be to adopt/use the innovation), *trialability* (the extent to which the potential adopter can adopt the innovation in small doses or on a trial basis), and *observability* (how visible the results of the innovation will be to others; Rogers, 1995). However, variables other than the perceived attributes of the innovation also play important roles in potential adopter's decision making. Within DOIT, and as supported by empirical investigation, potential adopters' innovation profile, background characteristics, and environmental characteristics are integral to the adoption process (Rogers, 1995, 2003).

Domain-Specific Innovativeness and Its Correlates

With respect to this study, one of the key variables within DOIT known to influence the adoption process is the domain-specific innovativeness (DSI) of potential adopters. Whereas general or "innate" innovativeness can be viewed as a trait characteristic of an individual, DSI is understood to be more flexible and responsive to the individual's environment within a specific context or setting (Citrin, Sprott, Silverman, & Stem, 2000). Citrin et al. (2000) state that domain-specific innovativeness "reflects the tendency to learn about and adopt innovations within a specific domain of interest and, therefore, taps a deeper construct of innovativeness more specific to an area of interest" (p. 296). In prior research, DSI was shown to be a better predictor of innovation adoption than general innovativeness (Citrin et al., 2000; Gatignon & Robertson, 1985; Goldsmith & Hofacker, 1991; Hirschman, 1980). More recently, and specific to CSPAP adoption, Webster, Caputi, et al. (2013) found that DSI significantly, positively, and directly predicted the extent of elementary generalist teachers' self-reported incorporation of classroom-based strategies to increase children's PA.

The degree of an individual's DSI places him/her into different types of adopters, including those who are the quickest to adopt an innovation (i.e., "innovators" and "early adopters"), who make up 2.5% and 13.5% of the population, respectively; those who follow suit at relatively faster or slower rates (i.e., "early majority" and "late majority"), who each make up 34% of the population; and those who take the longest to adopt it or never adopt it (i.e., "laggards"), who make up the remaining 16% of the population (Goldsmith & Foxall, 2003). Given that DSI is known to be more pliable than general innovativeness, identifying variables that may influence DSI and ultimately promote innovation adoption is important to the design and development of strategies aimed at increasing the number of innovators and early adopters in specific domains. Bartels and Reinders (2011) conducted a systematic review of 79 studies from consumer science research on innovativeness and its correlates. The authors then developed a conceptual model in which multiple factors are proposed to link with DSI and innovation adoption, including domain-specific variables (product involvement, product knowledge, and opinion leadership), demographics (e.g., age, level of education), social context variables (social identification and cultural values), and perceived control (self-efficacy and role clarity). There remains, however, a dearth of studies investigating variables associated with DSI and innovative behavior within educational settings.

Drawing from Bartels and Reinders' (2011) systematic review of DSI and its correlates, Rogers' seminal texts on DOIT (Rogers, 1995, 2003), and related research with a focus on school PA promotion (Webster, 2011; Webster, Erwin, & Parks, 2013; Webster, Monsma, & Erwin, 2010), this study explored the role of educational background (primarily CSPAP professional training and CSPAP knowledge), perceived school support for a CSPAP, and demographic variables in physical education teachers' DSI and CSPAP adoption behavior. Although no previous studies have specifically investigated these variables in relation to physical education teachers' PA promotion, research with preservice and inservice classroom teachers showed that CSPAP-related training, knowledge, and perceived school support were important factors in participants' school-based PA promotion.

Specific to training, preservice classroom teachers who had taken a course on school-based PA promotion reported higher perceived competence to teach physical education than their peers who had not taken such coursework (Webster et al., 2010). A subsequent study focusing on the aforementioned course showed statistically significant positive changes from the beginning to the end of the course (~16 weeks) in preservice classroom teachers' attitudes toward PA promotion, as well as perceived competence to teach physical education and promote PA in the classroom, at recess, and in before and after school contexts (Webster, 2011). Following similar coursework, preservice classroom teachers in a different study also reported greater willingness to integrate movement in their future classrooms (Webster, Erwin, & Parks, 2013). Researchers are also finding that CSPAP-related training is important for preservice physical education teachers (Kwon, Kulinna, van der Mars, Beardsley, & Koro-Ljungberg, 2017; Kwon et al., 2018), although such training is limited (Webster et al., 2016a) and its nature varies (Carson, Castelli, & Kulinna, 2017; Webster et al., 2016b). Little is known about how much CSPAP professional training inservice physical education teachers across the United States have received.

Knowledge of CSPAPs may be another key factor in physical education teachers' adoption of such programs. As mentioned earlier, according to DOIT (Rogers, 1995), knowledge of an innovation (e.g., awareness, how to use the innovation, how the innovation works) constitutes the first step in the adoption process and directly influences potential adopters' evaluation of the innovation. A DOIT study with 201 inservice classroom teachers (Grades K–6) in South Carolina found an indirect positive association between the teachers' awareness of a CSPAP-related state policy and their self-reported use of classroom-based strategies to promote PA (Webster, Caputi, et al., 2013).

In addition to knowing about CSPAPs, physical education teachers may be more inclined to adopt a CSPAP if they feel their school offers a supportive environment for program implementation. In the aforementioned study of Webster, Caputi, et al. (2013), perceived school support (e.g., supportive school administration, sufficient resources) mediated relationships between policy awareness, DSI, and PA promotion. Finally, reviews of innovativeness research in fields outside of a CSPAP context identify demographic variables (e.g., educational level, age, gender) as important to new product adoption (Bartels & Reinders, 2011; Rogers, 2003).

Purpose of the Study

Based on the existing theoretical and empirical literature reviewed above, the purpose of this exploratory study was twofold. First, we aimed to identify background, school context, and demographic variables that differentiate physical education teachers as educational innovators. Specifically, we investigated between-group differences in physical education teachers' DSI based on the teachers' background characteristics, perceived school support for CSPAPs, and demographics. Given that DSI is a key predictor of innovation adoption, answering this question will help in identifying physical education teachers who may be more and less likely to adopt educational innovations, such as a CSPAP. This information can be used to direct teacher professional development initiatives so that they are tailored to meet the needs of physical education teachers with different degrees of DSI.

Our second aim was to examine associations between physical education teachers' DSI, perceived school support, and CSPAP adoption. The questions underpinning this aim were, "What is the relationship between physical education teachers' perceived school support for a CSPAP and their innovativeness as educators?" and "What is the relationship between physical education teachers' educational innovativeness and their probability of adopting a CSPAP, after controlling for perceived school support?" Addressing these questions is important in determining whether perceived school support for a CSPAP may be a factor in physical education teachers' professional innovativeness, as well as understanding the unique role of such innovativeness in physical education teachers' adoption of CSPAPs.

Methods

Participants

Physical education teachers ($N = 407$) from national sample of public schools in the United States participated in this study. Teachers self-reported their age ($M = 42.15$, $SD = 12.10$), gender identification (48.65% female and 51.35% male), race/ethnicity (91.89% White, 4.86% Black or African American, 3.24% Hispanic or Latino, 2.16% American Indian or Alaska Native, 1.03% Asian, 0.54% Native Hawaiian or Other Pacific Islander, and 0.54% other), state where employed (43 states represented), current organizational level where employed (15.84% elementary, 3.27% elementary/middle, 32.24% middle, 7.65% middle/high, 34.43% high, 0.05% elementary/high, and 3.28% all levels), highest educational level obtained (39.25% bachelor's degree, 38.17 master's degree, 19.89% master's +30, 1.61% Ph.D., and 1.08% other), whether they were a licensed physical education teacher (97.31% = yes), and years teaching physical education in the K–12 setting ($M = 15.05$; $SD = 10.73$). Respondents also indicated their role (leader, supporter, or not involved), with respect to each of the five CSPAP components, and provided information about the characteristics of their CSPAPs (Table 1).

Instrumentation

An electronic survey was developed for a larger investigation of physical education teachers and CSPAP adoption. As part of that investigation, this study drew upon the parts of the survey designed to measure DSI, background/demographic variables, and CSPAP adoption.

Domain-specific innovativeness. Teachers' DSI was assessed using a previously validated measure (Webster, Caputi, et al., 2013), which was developed for elementary classroom teachers as adopters of PA promotion within the general education classroom environment. Participants responded to four items (Table 2) with slight modifications to the wording to target physical education teachers instead of classroom teachers, and to focus more broadly on CSPAPs, as opposed to just classroom-based PA. A 6-option Likert-type response scale ranging from *strongly disagree* to *strongly agree* was used with no neutral option. Participants could also select *don't know* as an option. Pilot test data were used

Table 1 Contextual Information for CSPAPs at Adopters' ($n = 139$) Schools

	Involvement of the survey respondent (i.e., physical education teacher)	PA promotion strategies used by component					
Physical education	Leader (87.05%) Supporter (9.35%) Not involved (2.16%)	Standards-based instruction (78.42%)	Assessment of student learning (69.78%)	Opportunities to learn (68.35%)	Opportunities for moderate to vigorous PA (73.38%)	None (2.88%)	
PA during school	Leader (64.75%) Supporter (25.90%) Not involved (7.91%)	Classroom-based physical activity (68.35%)	Recess (41.01%)	Physical activity assemblies (28.06%)	Physical activity drop-in activities (e.g., keeping the gym open during lunch; 41.73%)	None (7.19%)	
PA before and after school	Leader (38.13%) Supporter (38.85%) Not involved (19.42%)	Active transportation programs/options (23.02%)	Intramurals (28.06%)	Interscholastic sports (51.80%)	Physical activity clubs (49.64%)	None (10.79%)	
Staff involvement	Leader (28.78%) Supporter (46.04%) Not involved (23.02%)	Staff wellness programming (e.g., fitness programs/events for teachers, health screening for teachers; 61.15%)	Staff training for PA promotion (17.27%)	Administrators involved in promoting PA (29.50%)	Classroom teachers involved in promoting PA (53.96%)	None (17.99%)	
Family and community engagement	Leader (17.99%) Supporter (45.32%) Not involved (35.97%)	Facility joint use agreements with outside organizations (44.60%)	PA programs/events for families (30.22%)	Parents involved in PA promotion (27.34%)	Community members/ organizations (e.g., universities, YMCAs, church groups) involved in PA promotion (36.69%)	Active homework for students (22.74%)	None ((22.30%)

Note. Although there were 292 total adopters in the study, only 139 of these participants completed the survey items pertaining to their CSPAP involvement and characteristics at their schools. CSPAP = comprehensive school physical activity program; PA = physical activity.

Table 2 Descriptive Statistics ($N = 407$)

Item	*M*	*SD*	Skewness	Kurtosis
Is a CSPAP currently being implemented at your school? (0 = No, 1 = Yes)	0.71	0.453		
Perceived school support				
Overall, my school administration is supportive of implementing a CSPAP at my school.	4.19	0.722	.215	3.377
My school environment can be easily modified to implement a CSPAP.	4.09	0.775	−.702	4.522
Policies in my school district and/or state provide the support needed for a CSPAP at my school.	4.07	0.735	−.404	3.910
There is sufficient family/community support to implement a CSPAP at my school.	4.04	0.773	−.491	3.911
The school has enough materials/equipment to implement a CSPAP.	4.00	0.800	−.588	3.551
The school schedule allows for a CSPAP to be implemented.	3.97	0.859	−.778	3.180
Budgetary constraints at my school prevent us from implementing a CSPAP.	3.96	0.887	−.403	2.203
The academic curriculum in my school makes it hard for staff to implement a CSPAP.	3.88	0.910	−.631	2.074
My school facilities do not have enough space to implement a CSPAP.	3.84	0.939	−.850	2.004
Administrator buy-in is a barrier to implementing a CSPAP at my school.	3.18	0.924	1.006	2.405
There are too many obstacles at my school to safely implement a CSPAP.	3.10	0.808	.773	3.007
DSI				
If I learned that a new educational idea/practice was available, I would be interested enough to adopt it.	4.92	0.463	−1.564	7.048
I will consider adopting a new educational idea/practice even if it is the first time I have ever heard of it.	4.85	0.578	−2.214	7.908
I know more about new educational ideas/practices before most of the other physical education teachers I know.	4.07	0.735	−.030	3.773
In general, I am the first among other physical education teachers I know to learn about the latest trends in education/teaching.	4.04	0.747	−.389	3.798
I adopt more new educational ideas/practices than other teachers at my school.	4.02	0.751	−.449	3.914
In general, I am the first among other teachers at my school to adopt a new educational idea/practice.	3.97	0.759	−.461	2.919

Note. CSPAP = comprehensive school physical activity program; DSI = domain-specific innovativeness.

to examine the DSI scale by employing an exploratory factor analysis with the Bayesian estimation. This procedure was shown to yield accurate results with small sample sizes and ordered categorical data (Asparouhov & Muthén, 2010a, 2010b). One of the goodness-of-fit indices used in this analysis is the posterior predictive *p* value (PPP), which indicates the extent to which the posterior distribution fits the data. This probability estimate is based on a fit index *f*, which represents the likelihood ratio chi-square test of the null model against the proposed model (Muthén & Asparouhov, 2010). Another goodness-of-fit index is the 95% confidence interval (CI) of the difference in the *f* statistic between the real and the replicated data. When the middle point of this interval is close to zero, the PPP value is close to .5, and the model has an excellent fit (Muthén & Asparouhov, 2010). On the initial run, PPP was .485 (95% CI [−23.996, 22.519]). Although all factor loadings were above the recommended value of .320 (Costello & Osborne, 2005), two items had nonsignificant factor loadings. These items were “If I learned that a new educational idea/practice was available, I would be interested enough to adopt it” and “I will consider adopting a new educational idea/practice, even if it is the first time I have ever heard of it.” When these items were removed, all item loading were statistically significant and ranged from .862 to .976, PPP was .517 (95% CI [−14.601, 16.662]), and Cronbach’s coefficient alpha increased from .856 to .901.

Background and demographic variables. A range of background and demographic variables were explored as potential factors related to physical education teachers’ DSI in this study. Background variables included professional training to implement CSPAPs, knowledge about CSPAPs, highest level of education, years of physical education teaching experience, and organizational level where employed. Professional training was assessed with a single item (“I have had sufficient professional training to implement a CSPAP”) using a 6-point Likert-type response scale ranging from *strongly disagree* to *strongly agree* with no neutral option. Knowledge about CSPAPs was assessed with a single item (“How much did you know about CSPAP before starting this survey?”) using a 5-point scale (*nothing*, *a little*, *a fair amount*, *most of it*, and *everything*). Demographic variables included age, gender identification (“What gender do you identify with?”), and race/ethnicity.

Perceived school support. A previously validated measure (Webster, Caputi, et al., 2013) was used to assess perceived school support. The original measure was developed for elementary classroom teachers as adopters of PA promotion within the general education classroom environment. For this study, slight modifications were made to the items, including changing the wording to target physical education teachers instead of classroom teachers and broadening the focus from the classroom environment to a CSPAP. Participants responded to 11 items (Table 2) using a 6-point Likert-type scale ranging from *strongly disagree* to *strongly agree*, with no neutral option. There was also a *don’t know* option for participants to select. Factor analysis with Bayesian estimation using pilot data showed that the 11-item scale had an adequate fit to the data (PPP = .463, 95% CI [−19.702, 21.861]). After sequentially removing items with lower loadings, model fit improved even further (PPP = .499, 95% CI [−14.402, 14.595]), and Cronbach’s coefficient alpha increased from .789 to .921. The optimal model included four items, with loadings between .849 and .981.

CSPAP adoption. Participants responded either "yes" or "no" to a single item asking them whether their school currently has a CSPAP, which was described as the school "[providing] *OPPORTUNITIES*, through any variety or combination of program components, for *all students at your school to* (a) receive quality educational experiences designed to prepare individuals for a lifetime of participation in PA and (b) meet the national guideline for school-aged youth to accumulate at least 60 minutes of mostly moderate to vigorous PA each day (including time in and out of school)." Background information about CSPAPs and a list of program components (physical education, PA during school, PA before and after school, staff involvement, and family and community engagement) with examples was included for participants to use as a reference.

Procedures

The first author's (C.A. Webster) University of South Carolina Institutional Review Board approved this study prior to data collection. A federal website listing all public schools in the United States was used to randomly select 20 elementary schools, 20 middle schools, and 20 high schools from each of the 50 states. School websites, where available, were visited to obtain e-mail addresses of the physical education teachers who worked at the schools. This yielded 2,955 e-mail addresses. An invitation to participate in the study with a link to the survey was sent to all addresses, and the survey remained open for a total of 4 weeks. Follow-up invitations to participate were sent 1, 2, and 3 weeks after the initial invitation. A participant consent form initialized the survey so that all teachers who participated in the study understood the risks and benefits of participation, that data would be kept confidential, who to contact about the study, and that participation was voluntary. The response rate for the survey was 14% ($N = 407$), which was considered acceptable for this study, given that a response rate of 10% is usual for online surveys (Manfreda et al., 2008).

Data Analysis

Data screening and descriptive analysis. The first step was to examine missing values, as well as the distribution of survey variables using univariate and multivariate measures of skewness and kurtosis. Missing values were distributed completely at random, $\chi^2(254) = 251.490$, $p = .533$, and were imputed with the series mean. Indices of univariate kurtosis larger than 7, univariate skewness larger than 2, and multivariate kurtosis larger than 3 were considered indicative of nonnormality (Bentler & Wu, 2002; Chou & Bentler, 1995). Further, descriptive statistics were used to summarize survey responses.

Exploratory factor analysis. Exploratory factor analysis within the exploratory structural equation modeling framework (Marsh, Morin, Parker, & Kaur, 2014) with mean and variance adjusted weighted least squares estimation was used to examine the DSI and "School Support" latent variables. The exploratory structural equation modeling approach allowed the estimation of the following goodness-of-fit indices: (a) the χ^2 statistic and its p value, (b) the χ^2/df index, (c) the root mean square error of approximation index (RMSEA) and its 95% CI, (d) the comparative-fit index (CFI), (e) Tucker–Lewis index (TLI), and (f) the weighted root mean residual (WRMR). The χ^2 test informs on the overall fit of the model, where a nonsignificant χ^2 statistic indicates good fit (Barrett, 2007); because the χ^2 statistic is often sensitive to nonnormality, sample size, and model size, χ^2/df is frequently used as a measure of fit, where values lower than 3 indicate good fit (Finney & DiStefano, 2006). RMSEA values above .10 indicate poor fit, values between .08 and .10 indicate acceptable fit, and values between .05 and .08 indicate good fit, whereas values lower than .05 indicate excellent fit (Hu & Bentler, 1999). CFI and TLI values above .95 show excellent fit and values larger than .90 indicate good fit, whereas values below .90 indicate poor fit (Hu & Bentler, 1999). A WRMR estimate lower than one indicates good fit (Yu & Muthén, 2002; DiStefano, Liu, Jiang, & Shi, 2017). Items with lower loadings were sequentially removed until the models reached an optimal fit to the data. The internal consistency of the two scales was estimated by computing Cronbach's alpha coefficient.

Latent profile analysis. Latent profile analysis allows the estimation of an error-free categorical latent variable (C) based on a set of continuous observed indicators (Collins & Lanza, 2010). In this study, latent profile analysis was employed to distinguish groups of teachers based on their responses on four survey items measuring DSI. Models with two (Model 1) and three (Model 2) latent profiles were estimated using the robust maximum likelihood estimation procedure with the M*plus* 7.4 (London, UK) software.

Two goodness-of-fit indices were used to assess the extent to which hypothesized latent profile models fit the data: (a) the Akaike information criteria and (b) the Bayesian information criteria. These indices are often used to compare models with different numbers of latent categories or different model specifications (DiStefano, 2012); lower Akaike information criteria and Bayesian information criteria values indicate higher model parsimony and better fit to the data (Muthén, 2004; Vermunt & Magidson, 2002).

Latent profile models were also assessed based on measures of classification precision, such as (a) the average latent profile probabilities for the most likely profile membership and (b) classification probabilities for the most likely latent profile membership. These probabilities are reported as the diagonal elements of a $k \times k$ table (where k is the number of latent profiles specified in the model); the off-diagonal elements of the $k \times k$ table represent the percentages of misclassified cases (DiStefano, 2012). These probabilities were then used to estimate the overall entropy of each model. This index ranges from 0 to 1, where values closer to one indicate higher levels of classification precision and clear distinctions among groups (Ramaswamy, Desarbo, Reibstein, & Robinson, 1993; Vermunt & Magidson, 2002).

Latent profiles were described by aggregating survey responses and by cross-tabulating background, school support, and demographic information by group. One-way analyses of variance were used to determine whether quantitative variables, such as CSPAP knowledge, CSPAP professional training, perceived school support, and years of teaching physical education varied significantly across groups. Similarly, the χ^2 test was used to determine whether categorical variables, such as being a CSPAP adopter, and demographic characteristics varied significantly across groups.

Latent profile analysis with a covariate and a distal outcome. Another purpose of the study was to estimate the relationship between DSI (as measured by the categorical latent variable C) and the perceived level of school support. Factor scores on the "School Support" scale were included in the latent profile model as a covariate of C (Model 3). To examine the relationship between C and the probability of adopting a CSPAP, the binary variable "CSPAP adoption" (0 = "no" and 1 = "yes") was included in the latent profile model as a distal outcome of C (Model 4); therefore, Model 4 included the latent categorical variable *C*, "School Support" factor scores as a covariate of *C*, and "CSPAP adoption" as a distal outcome of *C* (Figure 1). This mixture model was estimated using the three-step approach proposed by Asparouhov and Muthén (2012). The traditional one-step approach may induce bias because the inclusion of a distal outcome may lead to changes in profile memberships, whereas the three-step approach aims to correct for classification error by (a) estimating the latent profile analysis model first, (b) creating a nominal most likely profile variable *N*, and (c) estimating the mixture model with a covariate and a distal outcome where *N* is an indicator of *C* with measurement error at the misclassification rate estimated at Step 1 (Asparouhov & Muthén, 2012).

Results

Descriptive Analysis

The survey variables used in this study had an approximately normal distribution. As indicated in Table 2, all estimates of univariate skewness and kurtosis were nonsignificant. Further, Mardia's coefficient of multivariate kurtosis was nonsignificant for both the DSI (multivariate kurtosis = 2.12, $p = .420$) and the School Support (multivariate kurtosis = 2.24, $p = .210$) survey scales. The majority of respondents (71.2%, $n = 290$) reported adopting a CSPAP (Table 2). As indicated in Table 2, most participants perceived high levels of school support. The item with the highest rating in the School Support scale was "Overall, my school administration is supportive of implementing a CSPAP at my school" ($M = 4.19$, $SD = 0.722$). Similarly, the majority of respondents reported high levels of innovativeness. The item with the highest mean in the DSI scale was "I know more about new educational ideas/practices before most of the other physical education teachers I know" ($M = 4.07$, $SD = 0.735$).

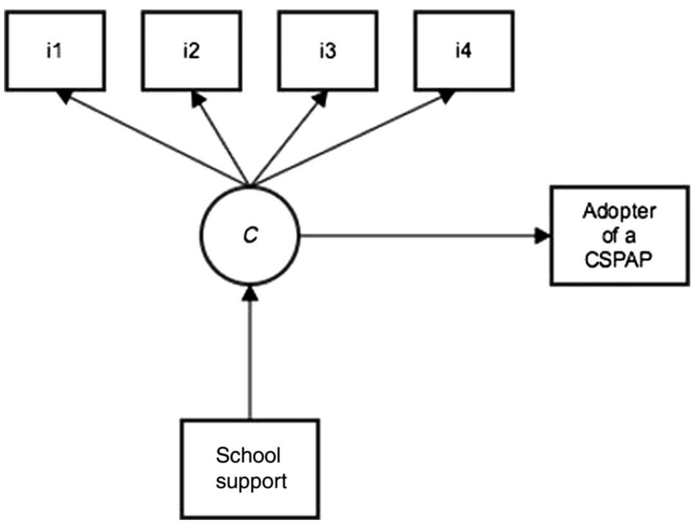

Figure 1 — Hypothesized LPA model with a covariate and a distal outcome (Model 4). *Note*. CSPAP = comprehensive school physical activity program; LPA = latent profile analysis.

Exploratory Factor Analysis

To improve model fit, two survey items with lower factor loadings were sequentially removed from the DSI scale. These items were "If I learned that a new educational idea/practice was available, I would be interested enough to adopt it" and "I will consider adopting a new educational idea/practice, even if it is the first time I have ever heard of it". Their factor loadings were .693 ($p < .001$) and .649 ($p < .001$), respectively. Although these loadings were not very low, their removal reduced the WRMR value from 3.876 to .979. The other goodness-of-fit indices also improved, showing that the final solution had an acceptable fit to the data, $\chi^2(2) = 45.768$, $\chi^2/df = 22.884$, RMSEA = .034, CI [0.017, 0.051], CFI = .977, TLI = .960. The four items included in the final factor solution along with their factor loadings, *SE*s, *t* statistics, and *p* values are reported in Table 3. Cronbach's alpha coefficient of internal consistency for this scale was .892. Goodness-of-fit indices for the School Support continuous variable showed that the observed variables were good measures of this construct and that this factor had an acceptable fit to the data, $\chi^2(2) = 29.048$, $\chi^2/df = 18.024$, RMSEA = .082, 95% CI [0.071, 0.093], CFI = .979, TLI = .937, WRMR = .656. After sequentially removing items with lower loadings, an optimal solution including four items was reached. The items included in the School Support factor along with their factor loadings, *SE*s, *t* statistics, and *p* values are reported in Table 3. Cronbach's alpha coefficient of internal consistency for this scale was .822.

Table 3 Factor Loadings

Item	Loading	*SE*	*t*	*p* value
DSI				
I know more about new educational ideas/practices before most of the other physical education teachers I know.	.863	0.012	69.629	.000
I adopt more new educational ideas/practices than other teachers at my school.	.855	0.015	56.502	.000
In general, I am the first among other teachers at my school to adopt a new educational idea/practice.	.833	0.015	55.591	.000
In general, I am the first among other physical education teachers I know to learn about the latest trends in education/teaching.	.824	0.016	51.145	.000
Perceived school support				
Policies in my school district and/or state provide the support needed for a CSPAP at my school.	.840	0.022	38.125	.000
There is sufficient family/community support to implement a CSPAP at my school.	.710	0.026	27.695	.000
Overall, my school administration is supportive of implementing a CSPAP at my school.	.675	0.025	27.525	.000
My school environment can be easily modified to implement a CSPAP.	.665	0.026	25.490	.000

Note. CSPAP = comprehensive school physical activity program; DSI = domain-specific innovativeness.

Latent Profile Analysis

Entropy and goodness-of-fit indices for Models 1–4 are reported in Table 4. Model 3 and Model 4 have the best fit to the data. Although estimates were identical for the two models, Model 4 provided additional information on the relationship between *C* and its distal outcome; therefore, Model 4 was selected as the optimal model. This model had extremely high classification precision: entropy was 99.9%, and average latent profile probabilities and classification probabilities for most likely latent profile membership ranged from 99.8% to 100% (Table 5).

The latent categorical variable *C* included three groups of individuals who differed based on their reported innovativeness: (a) "average innovativeness" (AI), $N = 313$, (b) "high innovativeness" (HI), $N = 51$, and (c) "low innovativeness" (LI), $N = 43$ (Figure 2).

As reported in Table 6, there were significant differences in School Support factor scores between the three groups, $F(2, 404) = 1{,}208$, $p = .000$, $\eta^2 = .857$; the Tukey HSD post hoc procedure showed significant mean differences between (a) HI and LI ($M = 3.36$, $SE = 0.06$, $p = .000$), (b) HI and AI ($M = 1.76$, $SE = 0.05$, $p = .000$), and (c) AI and LI ($M = 1.60$, $SE = 0.05$, $p = .000$).

Individuals in the three groups also reported significantly different levels of professional training for implementing a CSPAP (Table 6). The HI group reported the highest level of training ($M = 3.71$, $SD = 1.47$), followed by the AI group ($M = 3.21$, $SD = 1.42$) and the LI group ($M = 2.81$, $SD = 1.52$). The Tukey HSD post hoc procedure showed a significant mean difference between the HI and the LI groups ($M = 0.892$, $SE = .304$, $p = .010$). Groups also differed significantly on their reported knowledge of CSPAP before taking the survey. The HI group reported the highest level of knowledge ($M = 2.59$, $SD = 1.20$), followed by the LI group ($M = 2.09$, $SD = 1.09$) and the AI group ($M = 1.98$, $SD = 0.99$). The Tukey HSD post hoc analysis showed a significant mean difference between the HI and the AI groups ($M = .610$, $SE = .189$, $p = .004$). Further, a χ^2 test showed that the HI group included a larger than expected proportion of individuals who did not adopt a CSPAP, 41.2%, $\chi^2(2) = 6.903$, $p = .032$, standardized residual = 1.7.

The three groups did not differ significantly on characteristics such as age, racial distribution, educational level, and organizational level of the school (Table 6); however, it can be noted that the HI group was predominantly White (96%), had the largest proportion of individuals with a doctoral degree (4%), and had the largest percentage of middle school teachers (41.2%). Further, the HI group included a significantly larger proportion of females, 66%, $\chi^2(2) = 7.812$, $p = .020$, standardized residual = 1.7.

Relationship Between *C* and the Covariate

There was a statistically significant relationship between School Support factor scores and the latent variable *C*. In reference to the HI profile, there was a negative, statistically significant relationship between School Support factor scores and the probability of membership to the LI group (estimate = –0.943, $SE = 0.376$, $t = –2.510$, $p = .012$, odds ratio [OR] = 0.390) and to the AI group (estimate = –0.690, $SE = 0.225$, $t = –3.066$, $p = .002$, $OR = 0.501$). In other words, in reference to the HI profile, as School Support factor scores increased by one unit, the probability of membership to the LI profile decreased by 61.0%, whereas the probability of membership in the AI group decreased by 49.9%.

Relationship Between *C* and the Distal Outcome

The relationship between *C* and the distal outcome (CSPAP adoption) was significant for some latent profiles, but not for others. In relation to the HI latent profile, there was not a statistically significant relationship between the probability of membership to the LI profile and being an adopter of a CSPAP (estimate = 0.167, $SE = 0.425$, $t = .392$, $p = .695$, $OR = 1.18$); however, there was a statistically significant relationship between the probability of membership to the AI group and being an adopter of a CSPAP

Table 4 Goodness-of-Fit and Classification Precision by Model

	Model 1	Model 2	Model3	Model 4
Entropy	0.982	0.986	0.999	0.999
AIC	3,937.788	2,848.587	2,041.992	2,041.992
BIC	4,001.929	2,936.781	2,122.168	2,122.168
Sample adjusted BIC	3,951.159	2,866.972	2,058.705	2,058.705

Note. AIC = Akaike information criteria; BIC = Bayesian information criteria.

Table 5 Model 2 Average Latent Profile Probabilities and Classification Probabilities for Most Likely Latent Profile Membership by Group

	LI	HI	AI
LI			
Average latent profile probabilities for most likely latent profile membership	1.000	0.000	0.000
Classification probabilities	0.998	0.000	0.002
HI			
Average latent profile probabilities for most likely latent profile membership	0.000	1.000	0.000
Classification probabilities	0.000	1.000	0.000
AI			
Average latent profile probabilities for most likely latent profile membership	0.000	0.000	1.000
Classification probabilities	0.000	0.000	1.000

Note. LI = low innovativeness; HI = high innovativeness; AI = average innovativeness.

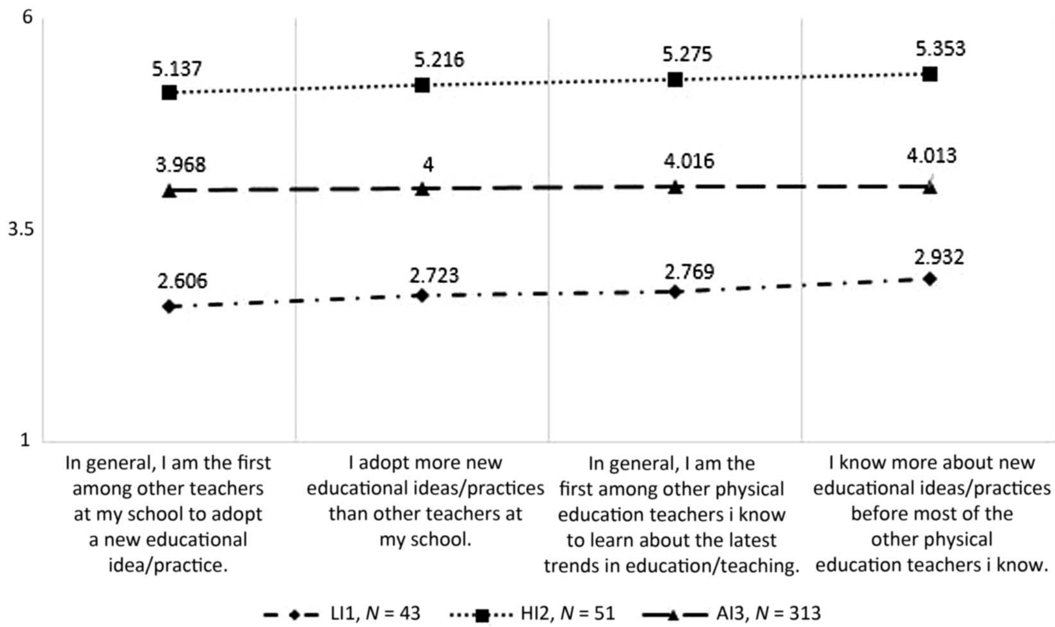

Figure 2 — Item averages by latent profile. *Note*. LI = low innovativeness; HI = high innovativeness; AI = average innovativeness.

(estimate = 0.713, *SE* = 313, $t = 2.279$, $p = .023$, *OR* = 2.04). Specifically in reference to the HI group, the probability of being an adopter changed by a factor of 2.04 for the members of the AI group. This finding can be attributed to the larger than expected proportion of nonadopters in the HI group, 41%, $\chi^2(2) = 6.903$, $p = .032$.

Discussion

The two aims of this study were to (a) identify background, school context, and demographic variables that differentiate physical education teachers' DSI and (b) examine associations between these teachers' DSI, perceived school support, and CSPAP adoption. Understanding why some physical education teachers may be more or less likely to adopt CSPAPs is critical to initiatives focused on implementing programming through schools to comprehensively achieve targeted PA outcomes. DOIT offers a relevant framework for research investigating new program adoption (Rogers, 1995, 2003), and it has been used in previous studies to investigate school-based PA promotion of elementary classroom teachers (Webster, Caputi, et al., 2013). This is the first study to examine the DSI of physical education teachers and how it relates to both school context and CSPAP adoption.

Consistent with DOIT and previous studies examining adopter categories (Rogers, 1995, 2003), results of this study classified participants into distinct levels of DSI, with most teachers represented in the AI group (76.9%) and fewer teachers in the HI group (12.5%) and LI group (10.6%). These numbers match the expectation to have mostly individuals with average levels of innovativeness in a given domain. As the participants in this study were from a nationally representative sample of public schools, the data support the likelihood that most physical education teachers in the United States do not see themselves as innovators or early adopters. Thus, even though nearly three quarters of the teachers in the study indicated their school had a CSPAP, not all of these teachers necessarily were leaders in adopting the program. Descriptive data from our survey indicated that 88% of 138 respondents saw themselves as program leaders in physical education, but this number dwindled for other CSPAP components. Specifically, 65% reported having a leadership role with PA during school, 38% reported having a leadership role in implementing PA before and after school, 29% reported having a leadership role with staff involvement, and 18% reported having a leadership role with family and community engagement. Other school professionals (e.g., classroom teachers, principals), parents, or community partners may have been primarily responsible for initiating and implementing significant portions of CSPAPs across the country.

Regarding the role of teacher background characteristics in DSI, descriptive data from this study support the idea that high-innovative teachers felt that they had received more sufficient professional training to implement a CSPAP and knew more about CSPAPs before taking the survey than average- and low-innovative teachers. There was a statistically significant difference between high- and low-innovative teachers' ratings of their professional training for CSPAPs, which suggests that such training may not be reaching or meeting the needs of physical education teachers who may be characterized as laggards. CSPAP knowledge only significantly differentiated between teachers in the HI and AI groups; however, individuals in the LI group rated their prior CSPAP knowledge higher than individuals in the AI group. Low-innovative teachers may have overrated their prior CSPAP knowledge, or average innovative teachers may have underrated what they knew about CSPAPs. Overall, the findings highlight the need for teacher professional development for CSPAPs to be tailored to individuals who are neither innovators nor early adopters in their schools and to incorporate a focus on developing these individuals' CSPAP knowledge.

In addition to CSPAP-related knowledge and professional training, school context (assessed as perceived school support in this study) was found to be an important variable in physical education teachers' DSI. Perceived school support for CSPAPs was the only variable shown to be statistically significant in differentiating all three innovativeness groups. Furthermore, in reference to the HI group, the higher that participants rated their perceived school support, the less likely they were to be an

Table 6 Group Comparisons

	Latent profile		
	LI, $N = 43$	HI, $N = 51$	AI, $N = 313$
CSPAP professional training, $F(2, 181) = 4.386$, $p = .014$, $\eta^2 = .046$			
M	2.81	3.71	3.21
SD	1.52	1.47	1.42
CSPAP knowledge, $F(2, 181) = 5.388$, $p = .005$, $\eta^2 = .056$			
M	2.09	2.59	1.98
SD	1.09	1.20	0.99
School support factor score, $F(2, 404) = 1208$, $p = .000$, $\eta^2 = .857$			
M	−1.166	1.705	−0.060
SD	0.402	0.428	0.303
Adopter, $\chi^2(2) = 6.903$, $p = .032$			
Nonadopter	37%	41%	26%
Adopter	63%	59%	74%
Organizational level, $\chi^2(2) = 7.381$, $p = .689$			
Elementary	23.8%	11.8%	14.4%
Elementary/middle	2.4%	2.0%	4.4%
Middle	31.0%	41.2%	28.9%
Middle/high	4.8%	9.8%	10.0%
High	31.0%	31.4%	38.9%
All grades	7.1%	3.9%	3.3%
Years of PE teaching experience, $F(2, 181) = 0.558$, $p = .573$			
M	14.0	16.27	14.8
SD	11.4	10.2	10.7
Highest educational degree, $\chi^2(8) = 5.552$, $p = .559$			
Associate	2%	0%	1%
Bachelors	37%	33%	43%
Masters	35%	39%	39%
Masters+30	26%	24%	16%
Doctoral	0%	4%	1%
Age, $F(2, 176) = 0.659$, $p = .518$			
M	43.9	42.2	41.3
SD	13.6	12.1	11.4
Gender, $\chi^2(2) = 7.812$, $p = .020$			
Females	42%	66%	43%
Males	58%	34%	57%
Ethnicity, $\chi^2(10)$, $p = .743$			
American Indian or Alaska Native	5%	2%	1%
Asian	0%	0%	1%
Black or African American	5%	2%	3%
Hispanic or Latino	2%	0%	4%
White	88%	96%	89%
Other	0%	0%	1%

Note. LI = low innovativeness; HI = high innovativeness; AI = average innovativeness; CSPAP = comprehensive school physical activity program; PE = physical education.

average innovator, and they were even less likely to be a low innovator. School support, therefore, appears to be a key factor in physical education teachers' DSI. Physical education teachers who work in school environments that are supportive of CSPAPs will be more innovative and respond both quickly and favorably to the idea of implementing a CSPAP. Further investigation into the specific aspects of the school environment that matter most to physical education teachers' DSI is needed to better inform initiatives in which these teachers are called upon to serve as innovators/early adopters for CSPAPs. It remains unclear which aspects of the school context, such as administrative support, school/district policies, building facilities, equipment/materials, budget, and curriculum, are particularly influential in the CSPAP adoption process.

After controlling for perceived school support, and in reference to the HI group, there was no relationship between the probability of CSPAP adoption and being a low innovator, but the probability of being a CSPAP adopter increased for the AI group. This can be explained by our finding that over 40% of the participants in the HI group were at schools that did not have a CSPAP. Although DSI is a known predictor of innovative behavior (Bartels & Reinders, 2011), including within the context of school PA promotion (Webster, Caputi, et al., 2013), physical education teachers who are innovators/early adopters at their schools may face challenges when trying to initiate CSPAPs, and these challenges could hinder program implementation. Previous research found that even in a school with extensive resources, grant funding, and external support from university partners, implementing a CSPAP required a major effort and was not sustainable (Egan et al., 2018). Thus, beyond physical education teachers' DSI, numerous other factors that were not investigated in this study may contribute to CSPAP adoption. For instance, from a DOIT perspective (Rogers, 1995, 2003), the potential roles of opinion leaders (influential individuals who spread either positive or negative information about the innovation) and communication channels (e.g., interpersonal, mass media) in CSPAP adoption might be important variables to explore in future research.

As with all research, this study has both strengths and limitations. One strength of the study is that data were collected from a national sample of public schools. Although the survey response rate was small, the random selection of schools increases the generalizability of this study's results. Another strength is the use of DOIT to examine CSPAP adoption. Few CSPAP studies have been framed using DOIT, despite the unique applicability of the theory to the adoption of innovative programs. A limitation of this study is that data were collected only from physical education teachers. Based on the contextual information provided in Table 1, targeting physical education teachers as survey respondents related to CSPAP adoption/implementation may be somewhat misguided in certain cases. CSPAPs are conceptualized as coordinated and collaborative efforts to promote PA (Society of Health and Physical Educators (SHAPE) America, 2015); as such, future investigations should broaden their focus to include the perspectives of other stakeholders in the CSPAP adoption process. In addition, this study was exploratory and did not pursue in-depth investigation into participants' background variables, such as the specific types of professional training (preservice and/or inservice) participants had received and what participants knew about CSPAPs (e.g., practical recommendations for implementing specific components, research describing case studies of different programs). As with most descriptive research on the prevalence of CSPAPs, this study is limited to self-report data. Surveillance studies that include other data sources, including direct observation of CSPAPs, are needed to build a more robust evidence base that can advance intervention design, professional training, and school practices aligned with goals in education and public health that serve to nurture and sustain more physically educated and active Americans. Furthermore, experimental designs investigating causal relationships between DSI, perceived school support, and CSPAP adoption should be pursued in future research. Finally, this study focused on the distinctions between adopters and nonadopters, on estimating the probability of being a CSPAP adopter, based on the level of innovativeness, and, indirectly, on the level of perceived school support. As the concept of CSPAP adoption becomes more clearly defined, future research may use multiple items and/or ordinal scales to measure varied aspects and different degrees of CSPAP adoption.

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