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Abstract

The overall aim for this study was to create and validate an instrument that helps researchers measure and better understand classroom teachers' efficacy toward providing physical activity throughout the school day. The development of the Teacher Efficacy Toward Providing Physical Activity in the Classroom Scale (TETPPACS) occurred in two phases. First, in study one, after item development and face validity review, an exploratory factor analysis was conducted with pilot data (N = 320) to discover the factor structure of the TETPPACS. Second, with a follow-up sample (N = 192), a confirmatory factor analysis (CFA) was performed to confirm the factor structure and measurement quality of the instrument. The final bi-factor model with three efficacy-specific constructs and the general efficacy construct resulted in an acceptable fitting two-group configural model across elementary and high school teachers (=363.791; CFI=.91; TLI=.87; SRMR=.066; RMSEA=.081). The results of this study suggest the new TETPPACS is a valid and reliable instrument to measure classroom teacher's efficacy toward providing physical activity during the school day. This instrument can help researchers further investigate how teacher efficacy relates to implementation and facilitation of physical activity experiences throughout the school day.

Keywords: active schools, comprehensive school physical activity programs, teacher efficacy, classroom teachers, classroom activity breaks, brain breaks

Introduction

The state of childhood physical inactivity in the U.S. remains an epidemic with 76% of children not meeting recommended guidelines for physical activity (PA; Child and Adolescent Health Measurement Initiative, 2016). PA is important for promoting health across numerous physical, social, and emotional aspects of life. On the other hand, sedentary behavior increases risk of chronic diseases and undermines health (Gonzalez et al., 2017). Given the known relationships between PA and sedentary behavior on overall health and wellness, national organizations such as the Institutes of Medicine (IOM) and the Centers for Disease Control and Prevention (CDC) have called for schools to play a vital role in promoting overall health and wellbeing by implementing whole-of-school approaches that incorporate PA before, during, and after-school (IOM, 2012; CDC, 2013). Through models such as a Whole School, Whole Community, Whole Child (WSCC), Comprehensive School Physical Activity Program (CSPAP), and Integrated Public Health Physical Education (IPHPE), stakeholders including principals, classroom teachers, and physical education teachers are encouraged to create structural changes that provide additional opportunities for youth to be physically active before, during, and after school.

Over the last decade, research on comprehensive programs aimed to facilitate the inclusion of PA and healthy eating throughout the school day has gained momentum. Researchers have examined how to create a culture of health within the school environment (Centeio et al., 2018; Brusseau et al., 2016; Chen & Gu, 2017; McKenzie et al, 2016), facilitate school-based best practices for PA promotion (Webster & Nesbitt, 2017), and develop effective advocates for school-based PA (Moore et al., 2018). Obtaining input from school stakeholders appears to be a key element for developing feasible strategies that remove common PA barriers (Dinkel et al., 2017; Mullins et al., 2019). In order for school administrators and teachers to implement new strategies, they must first believe they are capable of doing so. Research has previously linked teachers' self-efficacy beliefs with effective teaching and learning outcomes (Humphries et al., 2012). Therefore, it is important to study teachers' beliefs about providing PA opportunities for their students. A valid and reliable measure of teacher's efficacy toward implementing PA opportunities during the school day is much needed to advance this line of research given there is no known valid and reliable scale to do so.

Theory of Self-Efficacy

Self-efficacy, the belief one has in their ability to succeed in a given situation, plays a critical role in performance (Holden et al., 1990). Self-efficacy is thought to impact a person in many ways including behavioral choices, effort and persistence, and even cognitive and emotional responses (Bandura, 1997). In other words, self-efficacy beliefs can determine how people act, feel, think, and motivate themselves. People with higher levels of efficacy towards a specific task utilize resources to solve problems. Conversely, people who are less efficacious are more apt to rely on others to solve the problem or avoid the problem altogether.

According to Bandura (1997), self-efficacy beliefs are constructed from four main principles: (a) mastery experiences (personal experiences), (b) vicarious experiences (witnessing others experiences), (c) social influences, and (d) physiological and affective states in various situations. Mastery experience is an important and influential source of efficacy as it can provide firsthand evidence of whether or not a person is successful (Bandura, 1997). If a person is successful at something, their efficacy will increase for that particular task; if they fail, their efficacy typically will decrease. Vicarious experiences make up the second principle. When someone see's someone similar to themselves be successful, it may raise their belief that they may also be successful at the given task. Consequently, if they observe others fail, it has potential to lower their personal self-efficacy (Bandura, 1997). Social influence, otherwise known as verbal persuasion, is the third way of influencing a person's perceived level of efficacy. Social influences, such as words of encouragement can become especially important when sustaining a level of efficacy. Verbal persuasions might not be enough to raise levels of efficacy in adverse situations, but it could help sustain levels when doubt is expressed. The fourth and final influence that can affect a person's level of efficacy is the individual's emotional and physical needs. Often times, in stressful situations people exhibit signs of stress, such as fatigue and fear (Bandura, 1997). It is not uncommon for people who encounter stressful situations to perceive these stress signals as an inability to perform the given task. This perception occurs most often in people who have lower self-efficacy. On the other hand, those individuals who witness the same stressors and symptoms and are more efficacious often sense these signs as normal or unrelated to their ability and likeliness to succeed. Bandura also conceptualized self-efficacy as a mediator therefore suggesting that it should be an initial point of intervention when seeking behavior change (Bandura, 1977). As such, working first to improve self-efficacy by providing mastery and vicarious experiences and targeting social influences, and physiological states may lead to significant changes in behavior.

The power of self-efficacy has been studied and confirmed across diverse contexts including schools. In fact, there is a body of literature that specifically talks about efficacy in relation to teachers and their students.

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Teacher Efficacy

"The task of creating learning environments conducive to development of cognitive competencies rests heavily on the talents and self-efficacy of teachers" (Bandura, 1997, p. 240). In other words, teacher efficacy is considered an important factor in student and teacher success. Guskey and Passaro (1994) define teacher self-efficacy as the "belief or conviction that teachers can influence how well students learn, even those who may be difficult or unmotivated" (p.3). Numerous studies have extensively investigated self-efficacy as it relates to academic situations (Zhu et al., 2011), however, few qualitative and no known quantitative studies have examined classroom teacher efficacy in relation to providing PA opportunities for children throughout the school day. Self-efficacy theory asserts that teachers who feel efficacious about providing PA opportunities and who participate in PA themselves are more likely to have physically active students (Ernest & Pangrazi, 1999). We suspect that the lack of research in this area is two-fold. First, only recently have PA breaks within the classroom setting become more prevalent and accepted within the school setting (Masini et al., 2020; Watson et al., 2019). Second, the few instruments that allow for the specific context of self-efficacy toward providing PA opportunities focus on physical education (PE) teachers (Glowacki et al., 2016; Martin and Kulinna, 2003).

Measuring Teacher Efficacy Beliefs

The investigation of PE teachers' self-efficacy has been deemed important, with most studies examining general self-efficacy or self-efficacy about teaching specific content areas (Martin & Kulinna-Hodges, 2004). Currently, the Physical Education Teacher's Physical Activity Self-Efficacy Instrument (PETPAS) developed by Martin and Kulinna (2003) is one known scale to measure physical education teachers' efficacy toward implementing PA during physical education. However, the PETPAS only assesses physical education teachers' efficacy toward providing PA in the physical education classroom. The PETPAS instrument is a 16-item, multi-dimensional teacher self-efficacy scale that includes four factors: (a) student, (b) time, (c) space, and (d) institution. These four factors stem from physical education teachers' beliefs about major barriers to promoting PA. The student factor highlights the barrier of getting unmotivated students to be physically active. The time factor addresses barriers related the lack of time students spend in PE. The space factor represents common barriers such as large class size, inadequate facilities, and lack of equipment. Finally, the institution factor emphasizes barriers related to the low status of PE such as inadequate budgets, lack of administrative support, and class cancelations. It appears that these four dimensions of the PETPAS are interwoven. For example, Martin and Kulinna (2003) report correlations ranging between .62 to .91 with an average correlation of .78 among PETPAS factors.

Recent research efforts expanded the PETPAS scale to include a fifth dimension of physical education teachers' efficacy toward facilitating PA opportunities during the school day, outside of PE class time (Glowacki et al., 2016). Similar to Martin and Kulinna (2003), strong intercorrelations among self-efficacy factors were present. Furthermore, it stopped short of applicability for other teachers providing PA in the general school setting. Although this instrument expanded to include PA opportunities during the school day, it still only focused on PE teachers' efficacy toward implementation, lacking applicability for other teachers within the school setting who might be providing or asked to provide PA in the general classroom setting. This is an issue in these contemporary times where the onus on providing youth with routine PA now lies on classroom teachers.

Classroom Teacher Efficacy Toward Physical Activity

Given the ongoing state of obesity in youth as well as prioritizing whole of school approaches for health and PA interventions, promoting PA is becoming prevalent for numerous school personnel. Therefore, classroom teachers need to feel efficacious to teach children how to be physically active, which necessitates a research-driven understanding of classroom teachers' self-efficacy to promote PA and how it influences their students' health behaviors. Recent qualitative research has supported the notion that classroom teachers' efficacy plays an important role in their willingness and ability to promote PA in their classrooms (Michael et al., 2019; Webster et al., 2015). A review conducted by Webster et al. (2015) discussed different barriers that classroom teachers face when integrating movement into their daily routine. Top barriers included time for preparation, lack of resources, the support (or lack thereof) of the school environment, inadequate student responses, space and time limitations, and academic testing. A number of these barriers overlap with the barriers experienced by PE teachers that the PETPAS measures. However, to date there is no known quantitative measurement of classroom teachers' efficacy toward overcoming these barriers and effectively providing their students with PA opportunities throughout the school day.

Therefore, our purpose was to develop a quantitative measure focused on classroom teachers' efficacy to overcome common barriers toward providing PA throughout the school day. The development of the Teacher Efficacy Toward Providing Physical Activity in the Classroom Scale (TETPPACS) occurred in two phases which will be described as study one and study two below. First, for study one, items were developed, assessed by professionals for face validity; then pilot data was collected for an exploratory factor analysis (EFA) to discover the factor structure of the TETPPACS. Study one was the factor structure calibration step. Then, in study two, a second round of data was collected to confirm the factor structure and measurement quality of the instrument in two different levels of classroom teachers – elementary and secondary – with a confirmatory factor analysis (CFA) and examine validity relationships. Study two was the validation step. The following sections describe study one and two in detail. Each study had its own purpose, methodology, results, and discussion; a general discussion with overall conclusions regarding the instrument development is presented at the end.

Study One: Factor Structure Calibration Step

The initial creation of the TETPPACS was informed by the PETPAS scale (Martin & Kulinna, 2003). As stated previously, the PETPAS was designed for PE teachers and focused on four factors: (a) students, (b) time, (c) space, and (d) institution. Taking this into account, coupled with the qualitative literature that expressed many barriers for teachers integrating PA into their classrooms a new scale was developed. Based upon the qualitative literature an important factor for classroom teachers' efficacy was the opportunity to gain knowledge about providing PA breaks. At the initial conception of the new scale, researchers evaluated the PETPAS item pool and determined what factors and items fit within the classroom teacher context. The stem "I am confident that I can get my students active when . . ." was retained as it was not PE specific. Eight TETPPACS items were informed by PETPAS items. Specifically, the wording of four PEPPAS items were adapted to fit the classroom context. An example is the PETPAS institutional barrier item ". . . *my principal or athletic director does not provide adequate support for physical education*" was adjusted to ". . . *my principal does not provide adequate support for physical activity*." Another four items were created with the intent of mirroring question concepts asked on the original PETPAS but varied in the content to fit the classroom teachers' experience. For

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example, the TETPPACS only needed two items related to space (one for the classroom and one general). A ninth item was added, ". . . *the weather is bad and students can't go outside,*" to the TETPPACS based upon one item from the original pool of the PETPAS scale. This was added as it made sense in the context of the classroom that in some locations weather could be a barrier to offering recess. Finally, nine items were developed for the TETPPACS based on self-efficacy theory and the qualitative literature surrounding barriers of PA breaks. The educational barrier item ". . . *I can learn a variety of strategies to implement physical activity*" is an example of such an item. Thus, a total of 18 items were developed for the TETPPACS (see Table 1 for final 18 items). Five experts in physical education and PA reviewed the items for face and content validity. The five content experts who reviewed the items were academics in the fields of exercise psychology, physical education, and physical activity. Also, of interest, two of the content experts were former classroom and physical educators that taught in the school setting. Each of the experts were sent the proposed scale items and asked to provide feedback on face and content validity. They were also asked to provide suggestions on additional items or conceptual aspects that were missing. All five academics felt that the items met face validity for the purpose of this measure. Suggestions provided revolved around language to improve readability and clarity of the items and how the stem was worded.

Study One Method

After obtaining IRB approval from the primary university at the time the research was conducted [IRB NUMBER HERE], the researchers asked district and school level representatives, who they had previously worked with, to distribute a SurveyMonkey link to their teachers. Given the distribution mechanism, as well as the lack of feedback provided to the researchers by school administration regarding the link distribution process, a response rate could not be calculated.

Participants. Classroom teachers (N = 320, Male = 46) who participated in this study were invited via email to complete the online survey. After clicking the initial link, IRB required documents were presented and participants clicked agree to continue participation in the study. There were 167 elementary teachers, 61 middle school teachers, 68 high school teachers, and 24 others (K-8, K-12) from 3 school districts in the Midwest region of the U.S in this sample (*M* age = 42.6 years; *M* experience = 16.5 years). This demographic data is similar to current classroom teacher data across the United States which states 77% of teachers are female and 50% of teachers are elementary teachers (U.S. Department of Education, 2019).

Measures. Teachers were asked demographic items, including their age, gender, years of teaching experience, the type of school they currently taught in, grade level taught, and typical class size. With the newly designed 18-item TETPPACS, classroom teachers were asked to rate their confidence to overcome barriers to providing PA breaks in their classroom. The response scale was from 1 to 5, anchored by "Not at all confident" (1) and "Fully confident" (5). The stem was "I am confident I can get my students active when, . . ." and an example is "my students are not concerned with being physically active."

Data Analysis. There was 3.2% missing data across all items. For the 18 items of the TETPPACS the percent missing ranged from 0.6% (items 1 and 6) up to 5.3% (item 14). Given the low missing data on these items, mean substitution was used when conducting the factor analysis (FA) in SPSS v23 (IBM, 2017) to explore the factor structure of the items with the entire sample. The Kaiser-Meyer-Olkin (KMO), Bartlett's test of sphericity (significant), and the individual item KMO values were examined to ensure the sample size and relationships in the data supported conducting FAs. The FA was conducted with oblique rotation (direct oblimin) to explore a correlated, subscale factor structure. In addition to the scree plot, the following were examined for the factors of the

FA solution: factor eigenvalues (>1.0), percentage of the items' total variance accounted for, and each item loading significantly onto a distinct factor (Tabachnick & Fidell, 2007). The correlations between the extracted factors were also examined to determine if there was support for the existence of subscales as unique, correlated factors (correlations < .80).

Table 1

Factor Loadings from Study 1 FA Rotated Solution

Stem: I am confident that I can get my students active when...	Component			Final Factor
	Institutional	Student	Educational	
My students are not concerned with being physically active**	.402	.682		STU
My students are preparing for tests.		.718		STU
My students are having problems getting along.	.319	.726		STU
My students have a wide range of academic abilities.		.809		STU
My students have a wide range of physical abilities.		.812		STU
I have a crowded classroom of students.*	.404	.687		STU
My school does not have enough room outside/inside to provide students with adequate physical activity.*	.607	.373		IBE
The weather is bad and students can't go outside.*	.488	.478	.330	STU/IBE
I do not have enough time during the day to provide physical activity breaks.*	.768			IBE
I do not have enough time in the day to provide students recess.*	.790			IBE
I do not have enough time to prepare physical activity breaks	.803			IBE
Other teachers at my school do not value physical activity.**	.697			IBE
My principal does not provide adequate support for physical activity.**	.711			IBE
My principal puts pressure on getting high test scores.	.635	.312		IBE
I do not have enough equipment/resources for all my students to be physically active.**	.727			IBE
I can attend professional development focused on implementing physical activity.			.815	EBE
I can learn a variety of strategies to implement physical activity.			.874	EBE
I can improve my knowledge about how to get my students active.			.823	EBE

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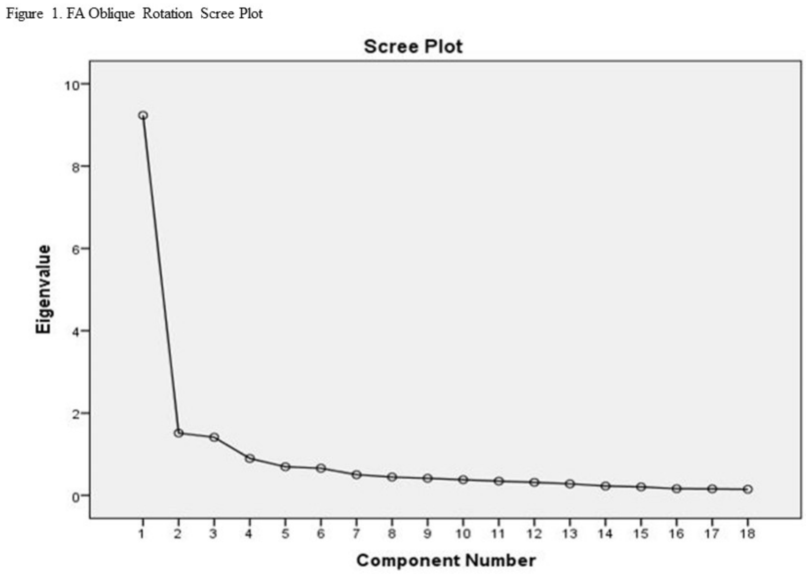
Note. Student Barriers Efficacy (STU); Institutional Barriers Efficacy (IBE); Educational Barriers Efficacy (EBE); ** represents items that were mirrored after questions on the original PETPAS survey; * represents questions that kept concepts of original PETPAS items

Study One Results

The KMO value (.924) supported the sampling adequacy for the analysis and Bartlett's test of sphericity was significant (p < .001) also supported conducting the FAs. The individual item KMO values (.855 – .969) exceeded the acceptable value of 0.50 (Tabachnick & Fidell, 2007). When run with oblique rotation, the three factors with eigenvalues greater than 1.0, which cumulatively accounted for 62% of the items' total variance, and were supported by the scree plot (Figure 1).The pattern matrix structure supported three distinct factors which aligned with the expected subscale structure. The first factor, comprised of eight items, represented teachers' efficacy to overcome barriers to PA breaks at an institutional level (equipment, time, pressure/support from administrators and peer teachers). The second factor, comprised of six items, represented teachers' efficacy to overcome challenges with students and implementation of PA breaks. The third factor, comprised of three items, represented teachers' efficacy to conduct PA breaks with access to knowledge and/or educational opportunities. Only one item (i.e., I am confident that I can get my students active when...The weather is bad and students can't go outside) did not load uniquely on only one of the three factors. See Table 1 for the item wording and respective FA rotated factor loadings. Finally, Cronbach alphas were calculated for these factors; all exceeded the .70 guideline (Tabachnick & Fidell, 2007): institutional barriers (α = .92), student barriers (α = .90), and educational barriers (α = .88). The institutional barriers factor was positively correlated with the student barriers (r = .67) and educational barriers (r = .55); while student barriers and educational barriers were also positively correlated (r = .49).

On average, the teachers reported moderate confidence to overcome the barriers to providing PA beaks presented by these items. Based upon the item means, the teachers reported the highest efficacy regarding "improving [their] knowledge about how to get [their] students active" and the least efficacy when their "principal does not provide adequate support for PA."

Figure 1
FA Oblique Rotation Scree Plot



Study One Discussion

The results from this initial data collection reveal three factors of the TETPPACS measure, which was similar to other contexts: institutional barriers to overcome, barriers related to the students to overcome, and the more knowledgeable an individual is the more efficacy they have to execute the goal behavior (i.e., conduct activity breaks in the classroom). Based upon this pattern matrix, the "bad weather" item may dual-load on the institutional and student barrier factors. Though not originally intended to be a dual-loading item, the logic of this item being related to both institutional and student barrier factors were understandable. Given the importance of this item conceptually to the general and subscale factors it was deemed best to keep this item for study two in order to determine if this dual loading was unique to the first sample analyzed, consistent across different samples, or simply a poor performing item that should be dropped from the TETPPACS.

The correlations among the self-efficacy factors were generally lower than previous research in physical education research (Martin & Kulinna, 2003). However, there was still evidence that overlap existed among the self-efficacy subscales. Previous studies exploring self-efficacy in classroom teachers suggests that dimensions of self-efficacy often load onto a single factor of self-efficacy (Fives & Buehl, 2010; Tschannen-Moran & Woolfolk-Hoy, 2001). A general factor of self-efficacy may represent teachers' overarching beliefs about their capabilities to impact students or represent self-efficacy beliefs about a task (e.g., promoting PA) that are not yet fully developed (Fives & Buehl, 2010). Therefore, greater investigation about the TETPPACS dimensions were deemed necessary including exploration of a bifactor structure that simultaneously examines factor structure representing a general factor as well as specific factors (Reise, 2012).

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Study Two

Although study one, as described above, supported the newly developed TETPPACS, further evidence regarding the "bad weather" item was needed to determine if this was qualified as a situation when '"bad" indicators are good' (Little et al, 1997). It was also the intent of study two to better understand the factor structure of the scale, specifically confirming the three-factor structure with and without a general efficacy factor (i.e., bifactor structure). Additionally, as part of study two and using the final factor structure, correlations with variables hypothesized to positively correlate, negatively correlate, or not correlate with classroom teachers' efficacy was examined to build validity evidence. Classroom teachers' efficacy was hypothesized to be positively correlated with their reported PA break frequency and potentially, negatively correlated with class size. Prior, qualitative research has provided mixed results regarding teachers' education level and years of experience in relation to efficacy to provide PA breaks, thus, these were hypothesized to be non-significant correlations (Parks, Solmon, & Lee, 2007). Gender was included because across different contexts males and females differ on their efficacy (Huang, 2013). Similar to study one, a sample of convenience was used, and a survey was sent out, using Survey Monkey, to classroom teachers across schools in four different school districts in the Midwest region of the U.S. Before participating in the survey, teachers electronically consented before continuing.

Study Two Method

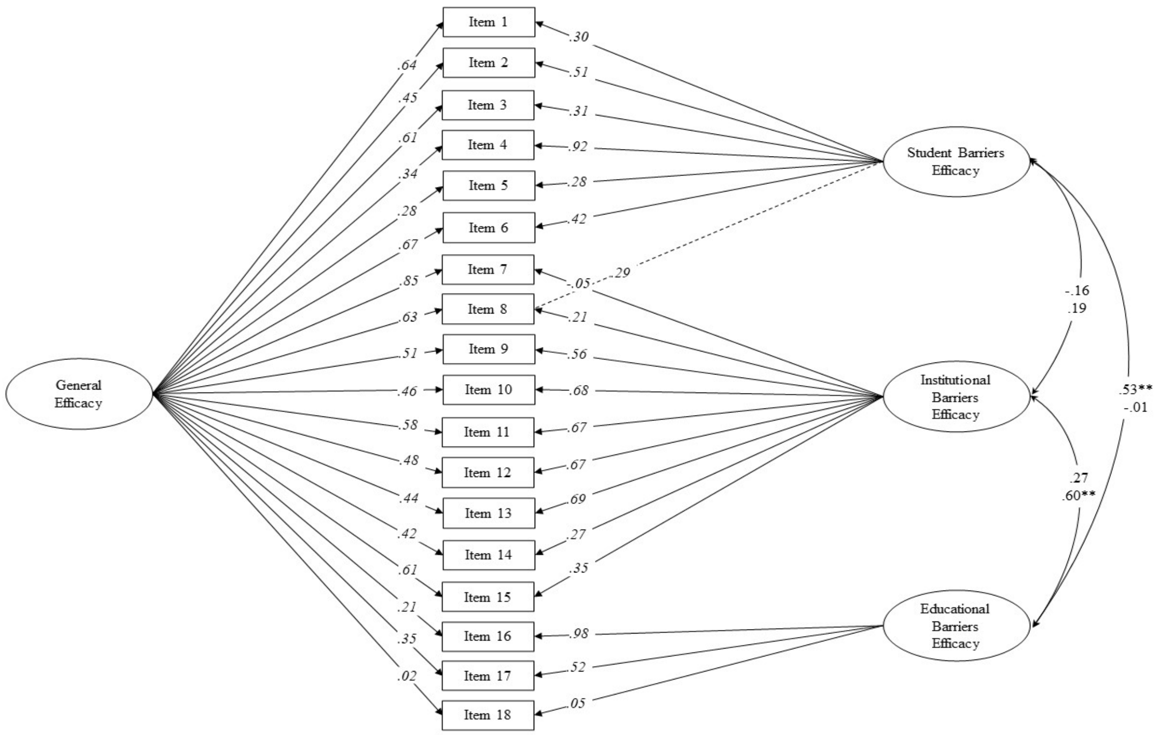
Participants. Classroom teachers (N = 192, Male = 64) participated in our follow-up data collection to examine the TETPPACS. There were 98 elementary (K-5) teachers and 94 high school (9-12) teachers who participated in the online survey. They averaged 40.45 years of age (SD = 11.54 years) and 12.75 years of teaching experience (SD = 5.05 years). Teachers reported their highest level of education as a Bachelor's (n = 18, 9.4%), Bachelor's Plus (n = 22, 11.5%), Masters (n = 82, 42.7%), Masters Plus (n = 55, 28.6%), PhD/EdD (n=7, 3.6%), and 8 (4.2%) did not respond.

Measures. Study two measures used the same demographic items and the 18-item TETPPACS as study one. Participants also responded to the item "*How often do you provide physical activity breaks in your classroom?"* with the response options: (1) less than once a week, (2) once a week, (3) twice a week, (4) 3-4 times a week, (5) daily, and (6) more than once per day.

Data Analysis. There was 2.9% missingness across the dataset. This missingness was handled by the FIML estimator in Mplus8.0 (Muthen & Muthen, 2017) when assessing whether the proper structure was a model with the three specific efficacy constructs or a bi-factor model. The bi-factor model parses item variance into specific-efficacy construct variance, and general efficacy construct variance (See Figure 2). In other words, the variance that is common between all 18 items is separated out into the general efficacy construct, and the variance common to the items measuring one specific efficacy type (i.e., educational, student, institutional) forms the specific-efficacy constructs. Therefore, the general efficacy construct correlations with the three specific-efficacy constructs are set to 0.0 (Myers, Ntoumanis, Gunnell, Gucciardi, & Lee, 2017). The bi-factor model allows for the analysis of predictors and outcomes of each of the four latent constructs (i.e., general efficacy and specific efficacy constructs). Overall model fit was assessed based upon the following criteria: CFI and NNFI ≥ .90; RMSEA and SRMR ≤ .08 (Little, 2013).

Figure 2
Bi-factor Teacher Efficacy Model

Figure 2. Bi-factor Teacher Efficacy Model



Note. CFI=.91; TLI=.87; SRMR=.066; RMSEA=.081. Standardized factor loadings are presented, and the elementary correlations are above the high school correlations. The General Efficacy construct was not correlated with the three specific barrier constructs. $**p < .005$ In addition to the correlation being significantly different from 0, it is also significantly different from the other group's correlation value.

Then measurement invariance was assessed across the elementary and high school teacher responses as a two-group model with the better fitting model structure. Elementary and high school teacher groups were selected, because if differences in measurement do exist across teachers, they would be expected to be most pronounced between these two ends of the k-12 educational spectrum given the differences in classroom structure and school day. Measurement invariance across the factor loadings (i.e., weak invariance) and the item intercepts (i.e., strong invariance) was assessed by the change in CFI (.01 change acceptable) and the more constrained model's RMSEA fitting within the 90%CI for the prior model's RMSEA (Little, 2013). Then, homogeneity of the latent parameters (i.e., variance, covariance, and means) were tested. Finally, the correlations between the efficacy constructs were assessed for significance. These latent parameter tests for significance at the structural model level used the Chi-square nested-model difference test with an alpha value of .005, because of the strength of the analyses being conducted (Little, 2013). Reliability of the latent constructs was calculated with McDonald's omega, which is interpreted as acceptable with a value of at least .50, representing 50% of the items' variance, on average, is accounted for by the latent construct (Tabachnick & Fidell, 2007). Finally, bivariate correlations with the following validity variables were calculated: teachers' reported gender, level of education, years teaching, class size, and PA break frequency. Pearson correlations were calculated with continuous variables and Spearman rho correlations with categorical variables were calculated.

Table 2
Descriptive Statistics for Study 2

Factor	General	Student	Institutional	Educational
General Efficacy	--	--	--	--
Student Barriers	--	--	.19	-.01
Institutional Barriers	--	-.16	--	.60**
Educational/Knowledge Barriers	--	.52**	.27	--
Elementary Students				
McDonald's omega (reliability ≥ .50)	.86	.69	.61	.58
Mean	3.41**	3.62	3.17	3.61
Standard Deviation	0.67	0.65	0.93	0.86
Recorded Response Range	1.78 - 5.00	2.14 – 5.00	1.00 – 5.00	1.33 – 5.00
High School Students				
McDonald's omega (reliability ≥ .50)	.81	.77	.62	.85
Mean	2.95**	3.39	3.28	3.57
Standard Deviation	0.62	0.72	0.78	0.92
Recorded Response Range	1.00 – 5.00	1.00 – 5.00	1.00 – 5.00	1.00 – 5.00

Note. * *p < .005; The correlations from CFA model: the top triangle is high school and bottom triangle is elementary values; general efficacy was not correlated with the specific efficacy constructs.

Study Two Results

First, the measurement quality of the two factor structures (3-specific factors; bifactor with 3-specific factors and general factor) suggested from study one's FA were compared by running the configural model for each structure. The 3-specific factor model had poor fit (χ^2_{264} = 615.388; CFI = .76; NNFI = .76; SRMR = .121; RMSEA = .12). The bifactor model with the general efficacy factor had better, though still not acceptable fit (CFI = .85; NNFI = .79; SRMR = .071; RMSEA = .10). Therefore, examining modification indices, four understandable modifications were made to the elementary portion of the bi-factor model: a) two residual correlations were added between items within the same specific component: item 9 with item 11 and item 14 with item 15; b) item 16 residual was fixed to 0, and c) item 8 dual-loading on student and institutional specific component factors. This resulted in an acceptable fitting two-group configural model (χ^2_{226} = 363.791; CFI = .91; NNFI = .87; SRMR = .066; RMSEA = .081). The inclusion of item 8 conceptually to appropriately represent the nomological net was deemed important enough to keep it rather than drop it (Little, Lindenberger, & Nesselroade,1999).

Table 3

Model Fit Indices for Initial, Measurement Invariance, Homogeneity of Latent Parameters, and Correlation Significance Tests for Study 2

Model Description	χ^2	df	Scaling Factor	CFI	NNFI	SRMR	RMSEA	RMSEA 90% CI	$\Delta\chi^2$	Pass?
3- Factor Configural Model	615.388	264	1.0903	0.763	0.725	0.121	0.12	.107, .132		
Bi-Factor Configural Model (Gen Eff + 3-Factor Model)	458.281	228	0.9489	0.845	0.791	0.071	0.104	.090, .118		
Modified Configural Model	363.791	226	1.0454	0.907	0.874	0.066	0.081	.065, .096		Yes
Weak Invariance Model	476.387	258	1.0482	0.853	0.825	0.116	0.095	.082, .109		No
Partial Weak Invariance Model	406.924	255	1.0644	0.897	0.877	0.089	0.08	.065, .094		Yes
Strong Model	454.648	269	1.0543	0.875	0.857	0.111	0.086	.072, .100		No
Partial Strong Invariance Model	432.257	268	1.0537	0.889	0.873	0.097	0.081	.067, .095		Yes
Omnibus test of Homogeneity of Variances and Covariances	459.333	275	1.0662	0.876	0.862	0.118	0.085	.071, .098	34.27	No
Omnibus test of Homogeneity of Means	472.995	280	1.0716	0.870	0.858	0.153	0.086	.073, .099	31.44	No

The model was then tested for measurement invariance between the elementary and high school teachers (see Table 3 for fit indices of all models). The model achieved partial weak invariance (ΔCFI = .01) after three loading constraints were relaxed (items 12, 13, and 17). Partial strong invariance (ΔCFI < .01) was achieved after freeing the intercept constraint for item 2. McDonald's omega values supported the reliability of the latent constructs (See Table 2).

Homogeneity of latent variances was met ($\Delta\chi^2_4$ = 13.86, p = .008). There were significant differences in two of the correlations between the specific components. The correlation between student and educational barriers was significantly different across groups ($\Delta\chi^2_1$ = 9.91, p = .002) and only significantly correlated for high school teachers (r = .52, p < .001). The correlation between institutional and educational barriers was significantly different across groups ($\Delta\chi^2_1$ = 8.31, p = .004) and only significantly correlated for elementary teachers (r = .60, p < .001). Student and institutional barriers were not significantly correlated or significantly different across elementary and high school teachers ($\Delta\chi^2_1$ = 3.14, p = .08). Finally, the means of the three specific efficacy factors were not significantly different from each other; whereas the general efficacy of the elementary teachers (M = 3.41) was significantly greater ($\Delta\chi^2_1$ = 24.23, p < .001) than the high school teachers (M = 2.95). See Table 2 for all latent correlations, means, and standard deviations.

Validity Correlations. Teachers reported class sizes ranging from 4 to 36 students (M = 24.91 students). The full range of PA break frequency responses were used: less than once a week (29%), once a week (4%), twice week (10%), 3-4 times a week (10%), daily (25%), more than once a day (21%). Teachers' years teaching, typical class size, and highest education level were not significantly correlated with general efficacy or the specific efficacy variables (See Table 4). Being male was negatively correlated with education barrier efficacy reports (r_s = -.16, p < .05). The frequency of PA breaks was positively correlated with general efficacy (r = .37, p < .01), student barrier efficacy (r = .43, p < .01), institutional barrier efficacy (r = .18, p < .05), and educational barrier efficacy (r = .16, p < .05).

Table 4

Validity Variable Correlations with TETPPAC Variables

Validity Variables	General Efficacy	Student Efficacy	Institutional Efficacy	Educational Efficacy
Years Teaching	-.06	-.06	-.01	-.04
Typical Class Size	-.10	-.03	-.08	-.02
Highest Education Level	-.07	-.06	-.02	-.04
Male	-.03	.05	-.03	-.16*
PA Break Frequency	.37**	.43**	.18*	.16*

Note. *p < .05, **p < .005

Study Two Discussion

The results of study two provide further support for the psychometric properties of the TETPPACS. Specifically, the bi-factor model supported the measurement structure for the general efficacy and the three specific efficacy factors. Having partial strong measurement invariance (i.e., all but three factor loadings and one intercept were equivalent) across school level further supported that there were not differences in item functioning across this grouping. However, there were significant differences between the primary and secondary teachers' efficacy constructs for the mean and correlation values. In addition, study two results provided validity evidence. Specifically, there was convergent validity evidence from the positive correlations between all four efficacy constructs and the teachers' reported PA break frequency. There was also divergent validity evidence with males reporting lower perceptions of education barrier efficacy (i.e., negative correlation). Finally, demographic variables (i.e., degree held, years teaching, and class size) that have not shown consistent relationships in qualitative research about teacher efficacy regarding PA breaks were not significantly related to the efficacy constructs in our model.

Discussion

This study confirms that the TETPPACS is a valid and reliable scale to measure teacher efficacy toward implementing PA during the school day, specifically with elementary and high school teachers. The focus of the calibration step with the study one analyses was to determine the factor structure for TETPPACS. Three subscales of classroom teachers' self-efficacy to provide PA classroom breaks were identified. These subscales – institutional barriers, student barriers, and educational barriers – aligned with classroom teachers' self-efficacy themes from previous qualitative research. The purpose of the validation step with the study two analyses was to confirm the measurement structure for the factors as well as build validity evidence. Overall, the items behaved equivalently across the elementary and high school teachers providing evidence for the measurement structure, including a general factor. Second, validity evidence was provided by the positive, negative, and non-significant correlations between the efficacy factors and the teachers' characteristics and most importantly their provision of PA breaks.

Understanding classroom teacher efficacy in providing PA experiences during the school day is important, especially given the push to incorporate whole-of-school approaches that integrate PA before, during, and after-school. Existing literature shows the importance of teachers' efficacy in the overall teaching and learning process (Humphries et al., 2016) as well as specific literature that discusses qualitative findings of teachers' confidence and efficacy and its relationship to classroom PA implementation (Michael et al., 2019). The results of this study provide a way to further investigate how classroom teacher efficacy plays a role in the implementation and facilitation of PA experiences throughout the school day. Although studies have shown that teachers' efficacy likely plays a role in the provision of PA breaks and overall PA of children at school, no known research has been able to measure this in a quantitative nature and therefore could not drill down on specific aspects of self-efficacy that might be playing a role in the relationship. The validity results support that the newly developed TETPPACS variables are positively correlated with classroom teachers' reported PA breaks. It is imperative that we better understand what factors of efficacy are associated with PA implementation by classroom teachers in order to enhance intervention design and planning. Further, with knowledge of which aspects of efficacy are drivers of PA implementation, professional development coordinators can refine their training strategies and differentiate their approach based on existing or non-existing levels of teacher efficacy.

Development of the TETPPACS in conjunction with study one and its refinement through study two is important and novel because this measurement tool is the first of its kind to assess the attributes of efficacy as they relate to classroom teachers' PA implementation. To date, research has indicated that knowledge is a precursor to self-efficacy and that without knowledge on a specific strategy such as classroom PA, one may not become efficacious. We also know that student and institutional factors may present barriers to classroom PA implementation because they may diminish teachers' efficacy. The initial validity evidence from study two found teachers' education level was not associated with their efficacy to provide classroom PA breaks, which supports the need for professional development or interventionist training to increase teachers' efficacy regardless of their education level. Furthermore, it suggests that there could be a gap in pre-service classroom teacher training that focuses on the importance of and the knowledge to implement classroom PA in the school setting. Targeting, tracking, and understanding classroom teacher efficacy toward PA beginning in teacher preparation could prove important in the implementation of PA practices once in the field.

Further, with the quantitative consideration that the TETPPACS affords, school leadership and interventionists alike can use data driven methods to tap into the varied states and traits of efficacy they are presented with based on their unique contexts and specific challenges. For example, if an interventionist can determine that barriers related to students are especially high in

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one school, that interventionist will know to provide specific support such as how to promote PA in crowded classrooms or when students lack motivation. In another school, the TETPPACS scores may reveal teachers lack knowledge about classroom PA indicating that training should focus on why it is important and beneficial to students, or maybe teachers are concerned about fitting the activity breaks into the school day and discussion can occur over how to restructure and "make time" without losing instructional time. Essentially the utilization of the TETPPACS has the capacity to move classroom professional development sessions from a one size fits all model to one that is specific to the unique contextual needs of individual schools and districts. Additionally, it can also be used as an assessment of training effectiveness for professional development designed to address teacher efficacy needs.

Results from study one led us to believe that there was a general efficacy factor which could be decomposed into three specific efficacy factors. The results from study two gave support for the overall general efficacy factor and the three separate factors (student barriers, institutional barriers, and educational barriers). These results, confirming the final structure of the TETPPACS, show many strengths. First, the scale can be used across grade levels and school types (i.e., elementary to high school). It was designed to be context specific, and includes specific factors as well an overall general factor of teachers' efficacy toward providing PA opportunities in the classroom setting. This is important because it provides breadth and depth of teacher efficacy across various contexts. That is, it is very informative in nature, provides specifics for teachers, administrators, and professional development coordinators to understand individual needs while also providing the overall state of efficacy in various situations. By having the ability to analyze specific and general factors, it will allow researchers and programmers alike to understand what factors to address and focus on in order to improve teacher efficacy and ultimately the provision of PA opportunities in the classroom.

Another important finding of this research study is the passing of measurement invariance across the different levels of teaching (elementary and secondary teachers). Although middle school teachers were not included in this study due to a low number of respondents, the results show the scale is valid and reliable and gives strong support to both extremes of the k-12 set (i.e., elementary and high school) of teachers. The results of the study reveal that indeed the new TETPPACS is valid and reliable for both elementary and high school teachers. This is important as it can be used in various situations and compared across different grade bands.

Limitations

Although this study has many strengths, there are limitations that should be acknowledged. First, convenience samples were collected. An email was sent to administration who passed it along to classroom teachers. There was no incentive attached to the responses and therefore it could be assumed that participants in this study are more motivated or interested in the topic of classroom PA than their counterparts who did not respond. A second limitation is the low percentage of men across the sample. Although our proportion of men in both samples was in line with the population of k-12 teachers, having enough men to explore if there are differences in efficacy for men and women teachers is an important future step. Finally, the teachers who participated in this study were predominately English speakers and taught in English. Therefore, caution should be taken when interpreting results that represent a different population of teachers and students.

Future Directions

Given this is the first measure to quantitatively examine classroom teacher efficacy toward providing PA opportunities for students, there are many implications and directions for future research. First, better understanding how teacher efficacy varies across participants as well as situations should be examined. Validity results provide initial evidence for potential gender differences for at least educational barrier efficacy; this needs to be explored further with larger and more diverse samples. Furthermore, do teachers in urban, rural, and suburban areas have various levels of efficacy? Does race/ethnicity, subject area taught, previous athletic/PA experience have a relationship with teacher efficacy toward providing PA experiences? Understanding how specific school and district situations, such as policies around classroom PA and other health outcomes, affect teacher efficacy. Finally, areas such as understanding the characteristics of improved efficacy, what influences teacher efficacy, and better understanding if improving levels of teacher efficacy toward PA opportunities in the classroom actually leads to more frequent opportunities and higher levels of PA for youth.

What Does This Article Add?

Given issues surrounding childhood physical inactivity both nationally and internationally, coupled with the call on schools to integrate PA as part of a whole child initiative (CDC, 2013), understanding ways to increase PA in the school setting is important. Classroom and subject specific teachers spend a significant amount of time with students during the day and have the potential to impact the opportunities provided for students to be physically active both in the elementary and secondary settings. One way to intervene and better understand teachers' implementation of such opportunities is through understanding their efficacy toward implementing PA in classrooms. The TETPPACS is the first scale developed to be able to better understand classroom teacher efficacy toward providing PA in the classroom setting and provides a way for researchers, professional development coordinators, and administrators to better understand the impact of teacher efficacy on the provision of PA opportunities in the school setting.

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