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This is the Published version of the following publication

Spittle, Sharna, Spittle, Michael, Itoh, Sho and Watt, Anthony P (2023)
Teaching efficacy of undergraduate physical education students toward concepts in physical education. *Frontiers in Education*, 8. ISSN 2504-284X

The publisher's official version can be found at
<https://www.frontiersin.org/articles/10.3389/feduc.2023.1124452/full>
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RECEIVED 04 January 2023

ACCEPTED 11 April 2023

PUBLISHED 27 April 2023

CITATION

Spittle S, Spittle M, Itoh S and Watt AP (2023)
Teaching efficacy of undergraduate physical
education students toward concepts in
physical education.
Front. Educ. 8:1124452.
doi: 10.3389/feduc.2023.1124452

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Teaching efficacy of undergraduate physical education students toward concepts in physical education

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Introduction: This study explored teaching efficacy for activities in physical education and how this efficacy relates to confidence and motivation in teaching physical education.

Methods: Students ($n = 291$, M age = 20.65 years, SD = 2.72) enrolled in a physical education degree course (Bachelor of Sport Science [Physical Education] or Bachelor of Education [P-12] [Primary Physical Education]) completed two questionnaires: the Physical Education Teaching Efficacy Scale (PETES) and Confidence and Motivation to Teach Primary Physical Education Questionnaire (CMTPE) to measure teaching efficacy, and confidence and motivation teach physical education.

Results: Participants reported lower teaching efficacy for applying scientific knowledge and teaching students with special needs, whereas they reported higher teaching efficacy for accommodating skill level differences and for instruction. Students were generally confident in management and planning in physical education, with 2nd and 3rd year students more confident than 1st year students. Intrinsic motivation for practice (to experience stimulating sensations of fun and excitement as motives for teaching physical education) and extrinsic motivation for performance (governed by rewards and restrictions by the teacher themselves) were the stronger forms of motivation for teaching physical education, whereas intrinsic motivation for knowledge (motivation teaching physical education for pleasure and satisfaction of learning new things) and disengagement (lack of motivation toward teaching physical education) were generally lower. Confidence and motivation were significantly related to teaching efficacy for most activities and confidence was more strongly related to teaching efficacy than motivation was. A path model of the relationships indicated that both year level and course influenced confidence, with confidence then influencing motivation and teaching efficacy for teaching activities in physical education.

Discussion: This study has highlighted the importance of confidence to motivation and self-efficacy for teaching activities in physical education. Practical implications include the identification of areas of lower teaching efficacy in teaching physical education and the relationships between confidence, motivation and self-efficacy in teaching activities in physical education.

KEYWORDS

physical education, primary school, secondary school, confidence, motivation

1. Introduction

Confidence can be viewed as an individual's belief toward their capabilities (Duda and Treasure, 2010) and affects performance, decisions, engagement in tasks and is important in self-regulation and motivation (Humphries et al., 2012). Self-efficacy is a closely related construct involving an individual's belief about their capability to complete a task (Bandura, 1977), that is, it is specific to a particular skill and situation (Duda and Treasure, 2010; Weinberg and Gould, 2019). Applying this to teaching physical education, confidence to teach physical education could be considered to be a perceived belief about competence to carry out a range of specific tasks and manage situations in physical education (Spittle et al., 2022a).

Research details that confidence relates to a belief about competency, whereas motivation refers to an intention to act (Gredler et al., 2004) and is a multi-faceted construct that consists of beliefs, perceptions, values, interests and actions that drive behavior (Deci and Ryan, 1985). Motivation is also related to confidence to teach and, as it comprises and intention to act, can influence what and how teachers deliver in physical education. Although there is a substantial research base of student motivation in education and in physical education (Teraoka et al., 2021), there is less research on teacher motivation in physical education (Spittle et al., 2009; Hein et al., 2012; Spittle and Spittle, 2014; Van den Berghe et al., 2014).

An influential and comprehensive theory of motivation that has been applied in physical education contexts is self-determination theory (SDT; Deci and Ryan, 1985, 2000). SDT outlines that rather than the amount of motivation an individual has, it is the type of motivation that relates to behavioral outcomes (Baumeister and Vohs, 2007). SDT describes three broad types of motivation based on the perception of the level of self-determination and regulation of behavior: intrinsic motivation (the most self-determined form of motivation, involving undertaking an activity out of interest, enjoyment, or inherent satisfaction), extrinsic motivation (undertaking activities for reasons other than inherent interest in the activity), and amotivation (the absence of intrinsic and extrinsic motivation) (Ryan and Deci, 2000a,b).

Exploring the relationships between motivation, confidence and self-efficacy is important, as confidence and self-efficacy are often mediators with motivation (Feltz and Öncü, 2014). Motivation, confidence, and self-efficacy, therefore, are considered to be related to one another, for example, high-confidence and self-efficacy can influence the tendency to attempt an activity and to persevere, and the tendency to view the activity as important and enjoyable (Schunk, 1990; Weiss and Ferrer-Caja, 2002). Furthermore, motivation is expected to be influenced by the situation and changeable depending on the context (Visser-Wijnveen et al., 2014), so in assessing the relationship with confidence in teaching physical education, exploring how self-efficacy is related to the specific activities of teaching physical education is important.

A study of the motivation and confidence to teach physical education (Spittle et al., 2022a) included detail of the development of the Confidence and Motivation to Teach Primary Physical Education Questionnaire (CMTPPEQ), a measure based on the theoretical foundations of SDT (Deci and Ryan, 1985, 2000) and Bandura's (1977, 1997) conceptual model of self-efficacy. The CMTPPEQ assesses two components of confidence to teach physical education and six components of motivation to teach physical education, representing intrinsic, extrinsic, and amotivation. Confidence comprises: management and planning, which relates to confidence in performing

common roles or duties when teaching physical education (e.g., planning a physical education program, establishing learning goals, communicating student achievements, maintaining records, and self-evaluating learning activities) and Implementation, which relates to delivering content specific to physical education (e.g., teaching motor skills and complex movements, dance, team games and sports, athletics, and fitness). Motivation comprises intrinsic motivation: knowledge (motivation for teaching physical education as an activity that is undertaken for pleasure and satisfaction of learning new things) and practice (experiencing stimulating sensations of fun and excitement as motives for teaching physical education); extrinsic motivation: student outcomes (teaching physical education because it is identified as worthwhile and beneficial for students and is integrated into teacher behavior), performance (governed by rewards and restrictions implemented by the teacher themselves (e.g., teaching physical education to avoid feelings of guilt or anxiety or to build up their ego and feelings of self-importance), professional expectations represent teacher behavior controlled by external sources (e.g., teaching physical education because it is required by the curriculum); and amotivation framed through the lens of disengagement and lack of motivation toward teaching physical education (e.g., not valuing physical education, not feeling competent to teach it, or not believing it will result in a desired outcome).

Spittle et al. (2022b) developed a model of the relationship between confidence and motivation for teaching primary school physical education using the CMTPPEQ. The model indicated experience and personal characteristics (type of teacher and years of teaching) influenced confidence in management and planning, with confidence then influencing intrinsic motivation, extrinsic motivation, and disengagement. The pre-service and in-service teachers in the study reported higher confidence in management and planning than implementation of physical education, they also were higher on motivation for knowledge, practice, and performance, and lower for professional expectations and disengagement.

Further, Spittle et al. (2022c) utilized the (CMTPPEQ) to explore the confidence and motivation of pre-service teachers specializing in primary school physical education. They reported that pre-service teachers reported higher confidence in implementing physical education and less confidence in management and planning. Pre-service teachers with less experience (i.e., 1st year of study, completed no physical education units, or had taught less than one hour of physical education on teaching rounds) were significantly less confident in both management and planning and implementation. Intrinsic motivation for practice and extrinsic motivation for performance were higher than other forms of motivation and males reported significantly higher extrinsic motivation in professional expectations. As extrinsic motivation for professional expectations comprises lower self-determination and teaching physical education for externally controlled reasons, further comparison of gender differences for motivation in physical education will add to our understanding of how to support undergraduate students in physical education.

Given the existing relationships between confidence and motivation, it is expected that confidence and motivation to teach physical education would be related to teaching efficacy for specific activities in teaching physical education. Bandura's (1977, 1997) model of self-efficacy combines confidence and expectations and the main antecedents on which expectations are based, including previous experience with the activity and vicarious experiences (Weinberg and Gould, 2019).

Individual and experience factors such as gender, course studied, year level of course (Weinberg and Gould, 2019) may also impact upon efficacy for teaching physical education, so comparison of how these factors may influence efficacy in physical education would be warranted. Self-efficacy is believed to be influential in confidence and motivation expectations which can be influential on teaching behavior (Spittle et al., 2022b). Evidence also exists demonstrating that specialist training in physical education teacher education is positively associated with efficacy for teaching physical education (Zach et al., 2012; Erbaş et al., 2014; Brennan et al., 2021), thus comparison of courses with different training requirements may be valuable to understanding how training influences efficacy. It would be expected that courses with more specific physical education content and curriculum may be beneficial for physical education teaching efficacy.

Teaching efficacy has been related to affirmative teaching and learning outcomes for students and teachers, such as student achievement (Bordelon et al., 2012), teacher job satisfaction and teaching attitude (Hoy and Spero, 2005; Caprara et al., 2006; Sas-Nowosielski and Kowalczyk, 2020), lower burnout (Skaalvik and Skaalvik, 2010; Brown, 2012; Oakes et al., 2013; Savaş et al., 2014) and the use of more effective teaching strategies and processes (Emilie et al., 2017), such as inclusion of students with special needs (Reina et al., 2019) and higher effort and persistence (Oakes et al., 2013; Savaş et al., 2014). Teaching efficacy, however, has been less commonly explored in mainstream physical education (Humphries et al., 2012), however, studies have focused on teaching efficacy related to inclusive physical education (e.g., Rekaa et al., 2019; Braksiek, 2022).

Bandura's (1977) conceptualization of self-efficacy beliefs can be aligned specifically with teaching activities. For example, motivating students, assessment, behavior management, content knowledge, and instruction, so that teachers may have higher self-efficacy for some aspects of teaching than others and this is likely to also be the case in physical education. Teaching efficacy in physical education therefore, could then be considered as multidimensional (Humphries et al., 2012; Choi et al., 2021), involving both self-efficacy toward teaching physical education (Spittle et al., 2022a) and teaching efficacy related to specific teaching activities in physical education, such as content knowledge, planning, management, instruction and assessment (Humphries et al., 2012; Choi et al., 2021). Consequently, it would be useful to explore how motivation and confidence in teaching physical education relate to teachers' efficacy beliefs specific to aspects of physical education teaching. The use of a multi-dimensional measure of self-efficacy in teaching physical education would allow this.

Humphries et al. (2012) developed the Physical Education Teaching Efficacy Scale (PETES) as multi-dimensional measure of efficacy for teaching physical education. The PETES was developed based on existing teaching efficacy literature, existing scales, and USA National Association for Sport and Physical Education's Teacher Education Standards. In developing the PETES, exploratory and confirmatory factor analysis with 592 pre-service physical education teachers produced 7 factors related to efficacy for teaching physical education: content knowledge (knowledge about activities one might teach, such as basketball or aquatics); applying scientific knowledge in teaching (academic content relating to exercise science, such as biomechanics or motor learning); accommodating skill differences (recognizing, planning for, and modifying activities to make them developmentally appropriate); teaching students with special needs (working with students with special needs in a regular physical

education classes); instruction (management, motivation, and communication in teaching physical education); using assessment (understanding and effective implementation of assessment); and using technology (awareness and use of technology in planning and teaching physical education).

The PETES has been used in several studies to explore self-efficacy toward specific activities related to teaching physical education and its relationship with outcomes such as physical literacy and anxiety related to tasks. For example, Ensign et al. (2020) used the PETES and interviews to explore influences on self-efficacy of 10 trainee physical educators across 7 occasions over 3 years. They reported that although teacher efficacy tended to be dynamic and specific to the context, it also tended to improve over time. Improvements over time were noted for content knowledge, accommodating skill level differences, teaching students with special needs, and instruction. There were also gender differences, with females higher on accommodating skill level differences, teaching students with special needs, whereas for instruction males were higher on three occasions and females higher on four occasions. Further comparison of these potential gender differences for teaching efficacy of specific activities in physical education may help clarify our understanding of potential gender differences in this area.

Erbaş and Ünlü (2020) looked at the relationship between teaching efficacy using the PETES and task-centered anxieties of physical education teacher candidates and reported that there were moderate positive correlations between teaching efficacy and task-centered anxiety. Sas-Nowosielski and Kowalczyk (2020) examined the relationship between self-efficacy for teaching physical education and teacher burnout of physical education teachers in Poland using the PETES. They reported moderate levels of burnout and relationships between self-efficacy for different activities and perceptions of burnout. Self-efficacy for applying scientific knowledge in teaching physical education and teaching students with special needs was positively related to perceptions of accomplishments. Self-efficacy for using assessment and using technology were negatively related to emotional exhaustion, whereas, self-efficacy for accommodating skill level differences was positively related and self-efficacy for instruction was negatively related to depersonalization.

A recent investigation by Brennan et al. (2021) of the self-efficacy of primary teachers undertaking a specialization in physical education to teach physical education used a questionnaire guided by the PETES (Humphries et al., 2012). The authors adapted the 15 questions relating to planning, assessment, instruction, and differentiation. They found that self-efficacy was generally high and that completing a specialization in physical education developed content knowledge and teaching skills. Self-efficacy was highest in planning, instruction and accommodating differences, and lower in assessment. Choi et al. (2021) explored relationships between preservice physical education teachers' perceived physical literacy and their teaching efficacy using the PETES in Hong Kong and Taiwan. They considered perceived physical literacy to be a perception of engagement and value of physical activity in their self-confidence, self-expression and communication with others, and knowledge and understanding of physical activity. They found that perceived physical literacy for self-expression and communication with others was related to self-efficacy in content knowledge, applying scientific knowledge in teaching, teaching students with special needs, and using technology and knowledge. Understanding of physical literacy was related to self-efficacy in accommodating skill level differences.

Self-efficacy was highest for instruction and lower for teaching students with special needs. The set of studies using the PETES (or modified version of it) indicated that it represents a useful multi-dimensional instrument for assessing self-efficacy for specific areas of teaching physical education. The measure could also be used to explore how motivation and confidence in teaching physical education relate to teachers' efficacy beliefs specific to aspects of physical education teaching.

1.1. Aims

This exploratory study examined the teaching efficacy of undergraduate physical education students for teaching activities in physical education and how this efficacy relates to their confidence and motivation in teaching physical education. Confidence and motivation in teaching physical education was assessed using the CMTPE and teaching efficacy for specific activities in physical education using the PETES. The specific aims of this study were to measure confidence and motivation to teach physical education, measure efficacy for teaching specific activities in physical education, compare differences in confidence, motivation, and efficacy for gender, course, and year level, and explore how motivation and confidence related to efficacy for teaching specific areas of physical education of those training to become physical educators.

2. Methods

2.1. Participants

Students enrolled in a Bachelor of Sport Science (Physical Education) or Bachelor of Education (P-12) (Primary Physical Education) degree were invited to participate in this study. Students were provided with information on participation in the study at the end of one of their classes by the researchers. Participants who agreed to participate were asked to complete a demographics information form and two questionnaires. Students were asked to return their questionnaires to a pigeon hole (box) located in the main office area of their College. Completion of the questionnaires implied consent to participate in the research. A total of 291 students with a mean age of 20.65 years ($SD=2.72$) completed the questionnaires, comprising 164 (56.4%) male and 127 (43.6%) female participants, with 127 (43.6%) students from the Bachelor of Sport Science (Physical Education) and 164 (56.4%) students from the Bachelor of Education (P-12) (Primary Physical Education). There were 102 (43.8%) first year, 131 (56.2%) second year, and 58 (24.9%) third year students.

2.2. Measures

A questionnaire pack consisting of a demographics form, and two questionnaires - the Physical Education Teaching Efficacy Scale (PETES) and Confidence and Motivation to Teach Primary Physical Education Questionnaire (CMTPE) - was used to measure demographic information, teaching efficacy, and confidence and motivation to teach physical education. The demographics form contained six questions which asked participants to indicate their

gender, age, course, year of degree, second teaching method, and entry method into the physical education course.

2.2.1. Confidence and motivation to teach primary physical education questionnaire

The Confidence and Motivation to Teach Primary Physical Education Questionnaire (CMTPEQ) (Spittle et al., 2022a) consists of two sections: confidence (24 items) and motivation (28 items) toward teaching primary school physical education. The CMTPEQ uses a 6-point Likert Scale ranging from 1 (strongly disagree) to 6 (strongly agree), with the item stem 'I am confident in my ability to' for confidence and "Why you would teach physical education" for motivation. There are two confidence subscales: management and planning (15 items) and implementation (9 items). Motivation consists of six subscales: representing intrinsic motivation (knowledge and practice), extrinsic motivation (student outcomes, performance, and professional expectations) and amotivation (disengagement). The CMTPEQ has acceptable reported reliability with Cronbach's alpha values greater than 0.70 for confidence subscales (management and planning=0.96 and implementation=0.89) and all motivation subscales, ranging from 0.73 for professional expectations to 0.91 for practice. In the current study the confidence subscales (Table 1) were acceptable (management and planning=0.92 and implementation=0.82) and the motivation subscales ranged between 0.65 to 0.85 (Table 2).

2.2.2. Physical education teaching efficacy scale

Humphries et al. (2012) reported that the PETES was developed based on existing teaching efficacy literature, existing efficacy scales, and the National Association for Sport and Physical Education's Teacher Education Standards. Respondents are asked to complete 35 questions on a 10-point Likert-response scale from 1 (disagree or cannot do) to 10 (agree or highly certain can do). The 7 efficacy factors of the PETES, comprise efficacy for: content knowledge (5 items), applying scientific knowledge in teaching PE (4 items), accommodating skill level differences (5 items), teaching students with special needs (5 items), instruction (6 items), using assessment (5 items), and using technology (5 items). Example items include "If one of my students was having trouble with a drill, I know ways to change it to make it easier for them" (accommodating skill differences), "I can demonstrate and explain a skill/drill so that the class understands what to do." (instruction) and "I can use assessments both for grading my classes and to help me plan" (using assessment). Humphries et al. reported that these factors were developed and confirmed through factor analysis and comprised items that logically relate and showed high levels of internal consistency, with Cronbach's alpha values ranging from 0.77 to 0.91. In the present study, Cronbach's alpha values were 0.65 and 0.87, respectively (Table 3).

TABLE 1 Descriptive statistics and internal consistency for the confidence subscales.

Subscale	Total scale score		Average score per item		Internal consistency
	M	SD	M	SD	
Management and planning	68.15	10.40	4.54	0.26	0.92
Implementation	40.22	6.78	4.47	0.39	0.82

TABLE 2 Descriptive statistics and internal consistency coefficients for the motivation subscales.

Subscale	Total scale score		Average score per item		Internal consistency
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Intrinsic motivation					
Knowledge	14.34	2.56	4.78	0.26	0.65
Practice	25.69	3.73	5.14	0.17	0.85
Extrinsic motivation					
Performance	29.47	4.63	3.82	0.10	0.81
Professional expectations	11.45	3.81	3.82	0.57	0.69
Student outcomes	21.15	2.74	5.29	0.24	0.79
Amotivation					
Disengagement	7.77	4.67	1.94	0.26	0.83

TABLE 3 Descriptive statistics and internal consistency for the physical education teaching efficacy scale.

Subscale	Total scale score		Average score per item		Internal consistency
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Content knowledge	34.89	6.66	6.98	0.89	0.69
Applying scientific knowledge in teaching PE	24.88	5.78	4.54	0.27	0.65
Accommodating skill level differences	38.92	5.95	7.78	0.17	0.83
Teaching students with special needs	28.97	9.42	5.79	0.68	0.87
Instruction	45.96	7.41	7.66	0.38	0.85
Using assessment	35.73	6.89	7.15	0.33	0.82
Using technology	36.46	7.92	7.29	0.65	0.81

Humphries et al. also reported acceptable test–retest correlation with values from 0.63 to 0.88 when tested over a three-day period.

2.3. Procedure

Students enrolled in a Bachelor of Sport Science (Physical Education) or Bachelor of Education (P-12) (Primary Physical Education) degree were invited to participate in this study. Participants were provided with a plain language statement and informed that their participation was voluntary and returning a completed questionnaire implied consent. The questionnaires took between 10–15 min to complete. A University Human Research Ethics Committee approved the study.

2.4. Data analysis

All statistical analysis was completed using SPSS and AMOS version 28. Cronbach's alpha coefficients were calculated for each of the teaching efficacy, confidence and motivation subscales to determine internal consistency. Independent samples *t*-tests were used to determine if there were any significant differences in the teaching efficacy, confidence and motivation subscales for gender and course. One-way analyses of variance (ANOVA) were used to determine if there were any significant differences in teaching efficacy, confidence and motivation subscales for year level. Significant differences were examined using Tukey's *post hoc* tests. Scores (mean and standard deviations) are presented as average score per item

in each subscale. Pearson correlations were calculated between the teaching efficacy, confidence and motivation subscales to demonstrate the level of association between teaching efficacy factors, and the different types of confidence and motivation to teach primary physical education. Path analysis was then used to develop a model of the relationships between confidence, motivation and teaching efficacy. Statistical analysis to facilitate the development of this model involved the following procedure:

1. Pearson's correlations to explore the relationships between the identified constructs to be used in the path models. This analysis was based on existing means and standard deviations.
2. Path analysis to evaluate the relationships that exists between the latent variables.
3. The path analysis was tested in a structural equation modeling program (AMOS 28) using the maximum-likelihood method of parameter estimation. The model was evaluated with the following fit indices Chi-square (χ^2), χ^2/df ratio, CFI, NFI, TLI, and RMSEA.

3. Results

3.1. Teaching efficacy

Students in the undergraduate physical education courses reported the highest teaching efficacy for accommodating skill level differences

and instruction, whereas teaching efficacy was lower for applying scientific knowledge and teachings students with special needs (Table 3).

significantly higher intrinsic motivation related to knowledge (Table 4).

3.2. Confidence

Students in the undergraduate physical education courses reported higher confidence for management and planning than for implementation (Table 1).

3.5. Course

Students in the Bachelor of Sport Science (Physical Education) reported significantly higher teaching efficacy for accommodating skill level differences and confidence in management and planning than Bachelor of Education (P-12) (Primary Physical Education) students (Table 5).

3.3. Motivation

The undergraduate physical education students reported higher intrinsic motivation for performance and extrinsic motivation for practice and lower scores for disengagement and intrinsic motivation for knowledge (Table 2).

3.6. Year level

There were significant differences for year level on the all 7 teaching efficacy subscales and both confidence factors: implementation and management and planning (Table 6). *Post hoc* tests revealed that 1st year students had lower teaching efficacy related to content knowledge, applying scientific knowledge in teaching PE, accommodating skill level differences, teaching students with special needs, instruction, using assessment, and using technology and confidence in implementation and confidence in management and planning than 2nd and 3rd year students. For the teaching efficacy subscales of applying scientific knowledge in

3.4. Gender

Males reported significantly higher teaching efficacy for applying scientific knowledge in teaching PE and higher extrinsic motivation for professional expectations, whereas female reported

TABLE 4 Descriptive statistics and t-test results for teaching efficacy, confidence, and motivation subscales by gender.

Subscales	Gender				t	df	p	d
	Male (n=162)		Female (n=127)					
	M	SD	M	SD				
Teaching Efficacy								
Content knowledge	7.06	0.85	6.87	1.03	1.16	289	0.25	0.14
Applying scientific knowledge in teaching PE	6.40	1.64	5.99	1.56	2.40	289	0.05*	0.28
Accommodating skill level differences	7.89	0.20	7.65	0.17	1.68	289	0.09	0.20
Teaching students with special needs	5.78	0.74	5.81	1.80	-0.12	289	0.90	-0.01
Instruction	7.65	0.37	7.68	0.41	-0.22	289	0.83	-0.03
Using assessment	7.16	0.30	7.13	0.39	0.15	289	0.88	0.02
Using technology	7.36	0.59	7.20	0.77	0.86	289	0.39	0.10
Confidence								
Management and Planning	5.51	0.50	4.51	0.31	-0.89	289	0.37	-0.10
Implementation	4.52	0.23	4.57	0.30	-0.58	289	0.56	-0.07
Intrinsic Motivation								
Knowledge	4.69	0.24	4.90	0.30	-2.13	289	0.05*	-0.30
Practice	5.09	0.17	5.20	0.19	-1.36	289	0.98	-0.16
Extrinsic Motivation								
Performance	5.78	0.09	5.27	0.17	-1.03	289	0.80	-0.12
Professional Expectations	3.96	0.55	3.63	0.60	2.18	289	0.05*	0.26
Student Outcomes	5.22	0.24	5.37	0.23	-1.78	289	0.55	-0.21
Amotivation								
Disengagement	2.06	0.30	1.79	0.22	1.94	289	0.64	0.23

*p<0.05, **p<0.01, ***p<0.001.

TABLE 5 Descriptive statistics and t-test results for teaching efficacy, confidence, and motivation subscales by course.

Subscales	Course				t	df	p	d
	Bachelor of Sport Science (PE) (n=127)		Bachelor of Education (P-12) (Primary PE) (n=164)					
	M	SD	M	SD				
Teaching efficacy								
Content knowledge	7.12	0.93	6.87	0.88	1.63	289	0.11	0.19
Applying scientific knowledge in teaching PE	6.30	1.73	6.15	1.62	0.87	289	0.38	0.10
Accommodating skill level differences	8.00	0.13	7.62	0.24	2.68	289	0.01**	0.32
Teaching students with special needs	5.77	0.77	5.81	0.62	-0.15	289	0.88	-0.02
Instruction	7.49	0.39	7.58	0.38	1.27	289	0.20	0.15
Using assessment	7.20	0.36	7.10	0.36	0.58	289	0.56	0.07
Using technology	7.46	0.62	7.16	0.70	1.62	289	0.11	0.19
Confidence								
Management and Planning	4.60	0.39	4.37	0.40	2.57	289	0.05*	0.30
Implementation	4.56	0.30	4.53	0.23	0.38	289	0.71	0.04
Intrinsic motivation								
Knowledge	4.73	0.29	4.82	0.26	-0.79	289	0.43	-0.30
Practice	5.06	0.19	5.14	0.18	-0.41	289	0.97	0.00
Extrinsic motivation								
Performance	4.91	0.10	4.91	0.11	-0.71	289	0.94	-0.01
Professional expectations	3.80	0.58	3.83	0.57	-0.44	289	0.66	-0.02
Student outcomes	5.28	0.25	5.29	0.22	-0.36	289	0.72	-0.02
Amotivation								
Disengagement	2.02	0.30	1.88	0.24	1.01	289	0.32	0.20

*p<0.05, **p<0.01, ***p<0.001.

teaching PE and teaching students with special needs, *post hoc* tests revealed that 2nd year students had lower teaching efficacy than 3rd year students. There were no significant differences on any of the motivation factors.

3.7. Relationships between confidence, motivation, and teaching efficacy

Pearson’s correlations for the relationships between the teaching efficacy, confidence and motivation subscales highlighted significant relationships between efficacy, confidence, and motivation factors (Table 7). Both confidence in management and planning and confidence in implementation were significantly related to all the teaching efficacy subscales (ranging between 0.50 and 0.80 for management and planning and 0.54 and 0.69 for implementation), indicating relationships between efficacy for teaching specific activities and confidence for teaching physical education. Correlations between teaching efficacy and motivation subscales were lower, particularly for extrinsic motivation factors and amotivation. Knowledge, Practice, and Performance were significantly related to all of the teaching efficacy subscales. Student Outcomes was significantly related to six of the teaching efficacy subscales, with only Applying scientific knowledge in

teaching PE not related. Professional Expectations was related to two of the teaching efficacy subscales (Applying scientific knowledge in teaching PE and Teaching students with special needs). Disengagement had a significant negative relationship with Instruction.

3.8. Hypothesized path model of the relationships between confidence, motivation, and teaching efficacy

The findings from the study revealed that there were differences in teaching efficacy, confidence and motivation of participants based on their chosen course and the numbers of years of study completed. Significant relationships between teaching efficacy, confidence and motivation were found through Pearson’s correlations. Using these results, a path diagram was constructed depicting a possible model of how the demographic variables of course type and year level affect confidence and how confidence then affects teaching efficacy and motivation.

The hypothesized path model in Figure 1 shows the order of effect moving from left to right with variables to the left of the confidence factor considered to have an effect on confidence to teach physical education and the confidence factor believed to have an effect on an individual’s teaching efficacy and motivation to teach physical education.

TABLE 6 Descriptive statistics and ANOVA results confidence and motivation by year level.

Subscales	Current year level						F	df	p	η^2
	1st year (n=102)		2nd year (n=131)		3rd year (n=58)					
	M	SD	M	SD	M	SD				
Teaching efficacy										
Content knowledge	6.57	0.75	7.13	0.86	7.35	0.89	8.27	2,288	0.001***	0.05
Applying scientific knowledge in teaching PE	5.61	1.81	6.38	1.48	6.93	1.40	19.21	2,288	0.001***	0.12
Accommodating skill level differences	7.51	0.22	7.86	0.14	8.09	0.28	4.95	2,288	0.01**	0.03
Teaching students with special needs	5.29	0.61	5.79	1.25	6.70	0.59	11.15	2,288	0.001***	0.07
Instruction	7.30	0.46	7.75	0.36	8.07	0.35	8.24	2,288	0.001***	0.05
Using assessment	6.69	0.34	7.29	0.38	7.63	0.37	10.32	2,288	0.001***	0.07
Using technology	6.94	0.66	7.43	0.70	7.60	0.56	4.23	2,288	0.05*	0.03
Confidence										
Management and Planning	4.23	0.32	4.55	0.28	4.70	0.28	9.20	2,288	0.001***	0.06
Implementation	4.00	0.80	4.35	0.51	4.80	0.15	9.38	2,288	0.001***	0.06
Intrinsic Motivation										
Knowledge	4.69	0.23	4.58	0.24	4.78	0.21	0.03	2,288	0.97	0.00
Practice	5.23	0.18	5.02	0.20	5.10	0.13	0.13	2,288	0.88	0.00
Extrinsic motivation										
Performance										
Professional expectations	3.75	0.82	3.93	0.34	4.08	0.49	1.59	2,288	0.21	0.01
Student outcomes	5.41	0.20	5.31	0.29	5.26	0.24	0.15	2,288	0.86	0.00
Amotivation										
Disengagement	1.62	0.22	1.67	0.23	2.09	0.21	0.59	2,288	0.56	0.00

*p<0.05, **p<0.01, ***p<0.001.

Path Analysis fit indices are listed in Table 8. The model displayed acceptable fit with a number of the fit indices (i.e., TLI, CFI and NFI) reaching their recommended cut offs. CFI, and NFI above >0.95, TLI with reaching the recommended cut off of >0.90. Cmin/DF was also above 3 which is within the acceptable ratios with RMSEA slightly above the 0.08 for acceptable fit.

In an attempt to improve model fit, paths believed to be non-significant were removed. The removal of the path between Motivation and Teaching Efficacy results in alterations to the model fit. These results are displayed in Table 8 and labeled as Model 2.2. The model produced improved fit indices with TLI, CFI and NFI all above 0.95, RMSEA <0.80 and a Cmin/d.f. ratio within acceptable levels. This improved model is shown as Figure 2.

4. Discussion

This study explored teaching efficacy in physical education activities of those training as physical educators and how motivation

and confidence related to teaching efficacy for specific areas of physical education. Self-efficacy for specific teaching activities is related to confidence and motivation in teaching physical education. Students in the Bachelor of Sport Science (Physical Education) and Bachelor of Education (P-12) (Primary Physical Education) appeared to report high teaching efficacy on teaching activities on the PETES. The average score per item for all seven efficacy factors was above 4, with four factors above 7. Previous studies using the PETES have determined that a mean score greater than 4 indicates higher teaching efficacy (Ensign et al., 2020; Erbaş and Ünlü, 2020; Neville et al., 2020; Brennan et al., 2021).

Participants recounted higher teaching efficacy for accommodating skill level differences and instruction and lower teaching efficacy for applying scientific knowledge and teaching students with special needs. This result is consistent with previous research using the PETES. Humphries et al. (2012) developing research for the PETES detailed higher scores on accommodating skill level differences, instruction, assessment, and using technology and lower scores on content knowledge, applying scientific knowledge, and teaching students with special needs. Choi et al. (2021) found that

TABLE 7 Pearson's correlations between confidence and motivation subscales.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Teaching efficacy															
1	Content knowledge														
2	Applying scientific knowledge in teaching PE	0.68**													
3	Accommodating skill level differences	0.67**	0.63**												
4	Teaching students with special needs	0.60**	0.63**	0.50**											
5	Instruction	0.64**	0.61**	0.83**	0.60**										
6	Using assessment	0.64**	0.70**	0.78**	0.56**	0.82**									
7	Using technology	0.63**	0.60**	0.65**	0.53**	0.68**	0.70**								
Confidence															
9	Management and planning	0.68**	0.61**	0.63**	0.50**	0.60**	0.63**	0.63**							
8	Implementation	0.55**	0.60**	0.64**	0.54**	0.69**	0.69**	0.63**	0.80**						
Intrinsic motivation															
10	Knowledge	0.20**	0.19**	0.25**	0.22**	0.35**	0.28**	0.28**	0.28**	0.39**					
11	Practice	0.21**	0.18**	0.26**	0.17**	0.36**	0.33**	0.32**	0.35**	0.45**	0.62**				
Extrinsic motivation															
12	Performance	0.14*	0.09**	0.19**	0.20**	0.30**	0.26**	0.29**	0.29**	0.39**	0.69**	0.80**			
13	Professional Expectations	0.03	0.14*	-0.01	0.16**	0.06	0.04	0.04	0.06	0.06	0.25**	0.17**	0.39**		
14	Student Outcomes	0.22**	0.11	0.27**	0.12**	0.34**	0.23**	0.32**	0.28**	0.36**	0.56**	0.71**	0.62**	0.15*	
Amotivation															
15	Disengagement	-0.07	0.09	-0.12*	0.04	-0.13*	-0.06	-0.11	-0.06	-0.15*	-0.10	-0.32**	-0.18	0.35**	-0.44**

*p < 0.05, **p < 0.01.

teaching efficacy was highest for instruction and lowest for teaching students with special needs. Brennan et al. (2021) found self-efficacy was higher in planning, instruction and accommodating differences, and lower in assessment. In their training study, they observed improvements in content knowledge, accommodating skill level differences, teaching students with special needs, and instruction. They reported that teacher efficacy tended to be dynamic and specific to the context and to improve over time. This may indicate that it is worth assessing changes in teaching efficacy over time in those who are training to be physical education teachers, particularly as we found differences between year levels in the current study.

Males reported significantly higher teaching efficacy for applying scientific knowledge in teaching than females. Choi et al. (2021) also reported that males indicated higher PETES teaching efficacy for content knowledge, applying scientific knowledge, accommodating skill level differences, with males and females similar on all other factors. Interestingly, Ensign et al. (2020) reported that females had higher teaching efficacy for accommodating skill level differences, teaching students with special needs, whereas males were higher for instruction on three measurement occasions and females higher on four occasions. Finding specific gender differences in teaching efficacy is also consistent with previous research on teacher efficacy in physical

education (Xiong et al., 2020), although the direction and nature of these differences has appeared to vary between studies using the PETES.

Year level differences were apparent, with 1st year students lower on teaching efficacy related to content knowledge, applying scientific knowledge in teaching PE, accommodating skill level differences, teaching students with special needs, instruction, using assessment, and using technology than 2nd and 3rd year students. In addition, for applying scientific knowledge in teaching PE and teaching students with special needs, 2nd year students had lower teaching efficacy than 3rd year students. These differences in year level are contextual as it could be expected that as students complete additional studies and have more teaching practice experiences they will develop greater efficacy toward the activities of teaching, although this may vary for different activities depending on exposure pedagogy and curriculum content across the course. For example, if students studied a unit on inclusion and diversity in 1st year they may have higher efficacy for teaching students with special needs earlier in their course. Studies using the PETES have not typically reported comparisons for year levels, however, Erbaş et al. (2014) reported that 3rd year preservice teachers had higher teaching efficacy for applying scientific knowledge in teaching physical education than 4th year

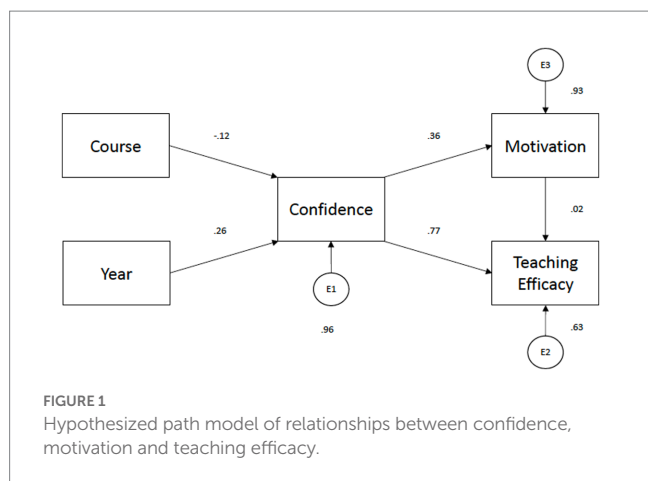


TABLE 8 Goodness of fit indices for the path model.

	χ^2 (df)	Cmin/DF	TLI	RMSEA	CFI	NFI
Model 1	15.670 (5)	3.134	0.936	0.086	0.968	0.954
Model 2	15.918 (6)	2.653	0.950	0.075	0.970	0.953

preservice teachers, while 4th year preservice teachers had higher teaching efficacy for accommodating skill level differences.

Differences were apparent between courses, including in the path model. Students generally reported high confidence toward teaching physical education on the CMTPEEQ, with students in the Bachelor of Sport Science (Physical Education) reporting significantly higher confidence in management and planning than Bachelor of Education (P-12) (Primary Physical Education) students. Differences in confidence in implementation and management and planning for Bachelor of Sport Science (Physical Education) and Bachelor of Education (P-12) (Primary Physical Education) students may also be due in part to the type of training. Students in the Bachelor of Education (P-12) (Primary Physical Education) are completing a specialization (major) in Primary Physical Education comprising 8 units but undertake significant practical experience in teaching so have more pedagogical training, whereas students in the Bachelor of Sport Science (Physical Education) complete up to 16 specialist units in sport science and physical education across their course but do not complete teacher training until after they complete their undergraduate training. In addition, 1st year students reported lower confidence in both implementation and confidence in management and planning than 2nd and 3rd year students. High confidence may be expected as these students are specialists in physical education, and previous research reinforced that specialist training in physical education is related to efficacy for teaching physical education (Zach et al., 2012; Erbaş et al., 2014; Brennan et al., 2021). Lower confidence for 1st year students in implementation and management and planning would also be consistent with this, as these students are likely to have completed less specialist training than those in 2nd and 3rd year (Spittle et al., 2022c).

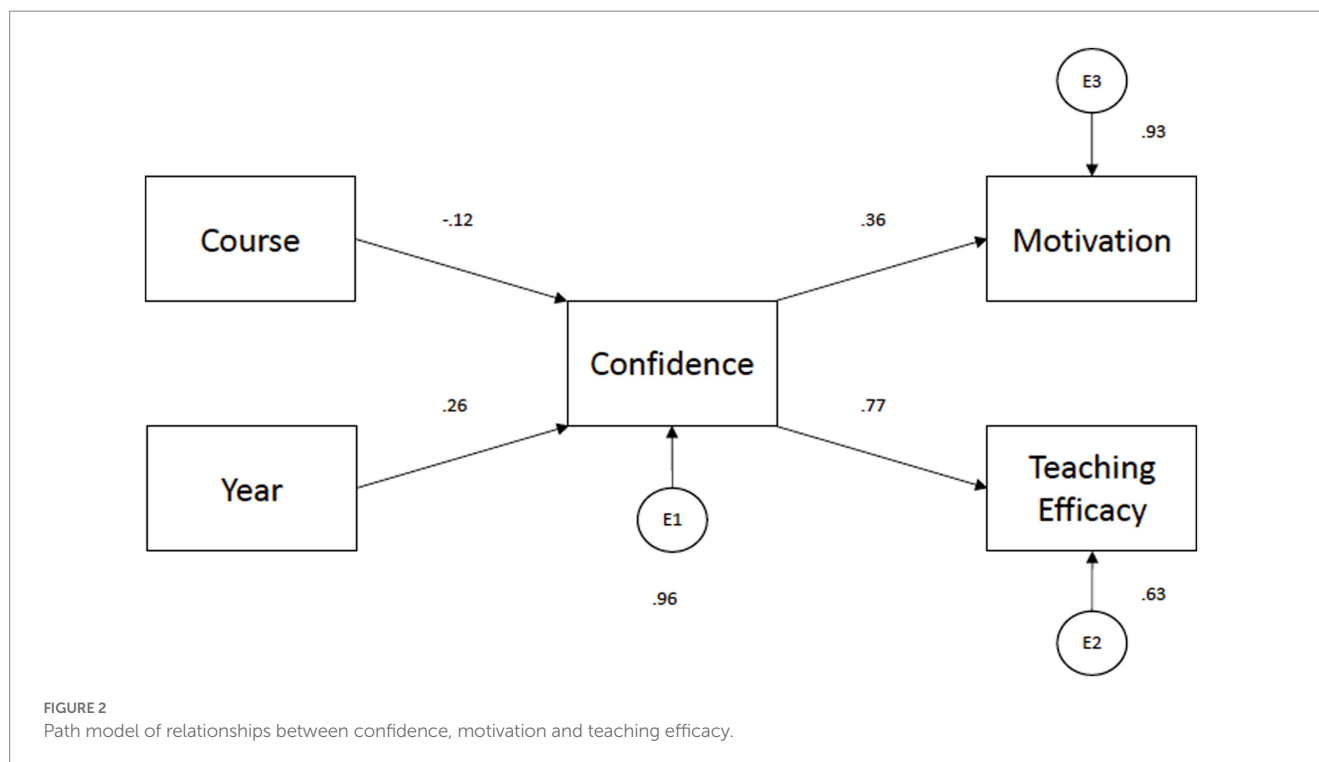
Students reported higher intrinsic motivation for practice and extrinsic motivation for performance and lower scores for disengagement and intrinsic motivation for knowledge, with males reporting significantly higher extrinsic motivation for professional

expectations and females reporting significantly higher intrinsic motivation related to knowledge. Similarly, Spittle et al. (2022c) found that intrinsic motivation for practice and extrinsic and motivation for performance were higher than other forms of motivation and Spittle et al. (2022b) reported higher motivation for knowledge, practice, and performance, and lower professional expectations and disengagement. Gender differences have also been found for motivation variables in previous research, with males reported significantly higher extrinsic motivation in professional expectations (Spittle et al., 2022c).

Teaching efficacy activities were significantly related to confidence and motivation for teaching physical education. Confidence in management and planning and confidence in implementation were significantly related to all the teaching efficacy subscales. Motivation subscales of Knowledge, Practice, and Performance were significantly related to all of the teaching efficacy subscales; Student Outcomes was significantly related to six of the teaching efficacy subscales, Professional Expectations was related to two of the teaching efficacy subscales, and Disengagement had a significant negative relationship with Instruction. Previous research has indicated that teaching efficacy toward teaching activities in physical education on the PETES are related to other aspects of teaching. For example, Erbaş and Ünlü (2020) found relationships between teaching efficacy and task-centered anxiety of physical education teacher candidates. Choi et al. (2021) also reported relationships between components of the physical literacy of preservice physical education teachers and their teaching efficacy. Teaching efficacy for specific activities were more related to confidence than motivation, which would be predicted given that confidence to teach physical education could be considered to be a perceived belief about the ability to carry out a range of tasks and situations in physical education (Spittle et al., 2022a) and that efficacy is a situation and context specific belief about capability to complete a specific task (Bandura, 1977). All of the teaching efficacy factors in the current study were related to confidence in both management and planning and in implementation.

Teaching efficacy for activities was related to a number of types of motivation, but the relationships were not as strong as between confidence and teaching efficacy. In addition, teaching efficacy was not related to extrinsic motivation for professional expectations or amotivation – disengagement. Motivation is a multi-faceted construct consisting of beliefs, perceptions, values, interests and actions that drive behavior (Deci and Ryan, 1985), with SDT describing different types of motivation based on the perception of the level of self-determination and regulation of behavior (Ryan and Deci, 2000a,b). Thus, there may be variation in the relationships between these constructs and teaching efficacy.

Professional Expectations and Disengagement represent motivation controlled by external sources and a lack of motivation toward teaching physical education, respectively. The finding that there was a lack of relationship between teaching efficacy and these forms of motivation, while other forms of motivation were related to teaching efficacy, could be indicative of the role of efficacy in mediating motivation (or vice versa). Specifically, it appeared that the current student cohort were motivated toward activities they have more efficacy toward, whereas motivation was less related to efficacy when they felt that they were being made to do the activity (Professional Expectations) or do not have any real motivation to do it (Disengagement). Confidence and self-efficacy are often mediators of motivation (Feltz and Öncü, 2014). Determining that most of the teaching efficacy activities were significantly related to confidence and motivation for teaching physical education, may indicate that



confidence in teaching physical education and teaching efficacy toward specific activities required in physical education are related to the drive to actually teach physical education or to undertake specific activities in teaching physical education. Further exploration of the relationships between motivation and confidence and self-efficacy is important in clarifying how these variables influence one another and the teaching of physical education.

The hypothesized path model of the relationships between confidence, motivation and teaching efficacy for activities in physical education indicated that both year level and course influenced confidence, with confidence then influencing motivation for teaching physical education and teaching efficacy for teaching activities in physical education. As discussed earlier, this may indicate the importance of experiences in courses in developing confidence, with those who have undertaken more studies specifically in physical education due to their course curriculum and year level having higher confidence. Confidence would be expected to influence motivation and also efficacy toward teaching physical education as indicated in the model as it has been suggested that confidence can influence the tendency to attempt, persevere with, and view the activity as important and enjoyable (Schunk, 1990; Weiss and Ferrer-Caja, 2002). A previous model of the relationship between confidence and motivation for teaching primary school physical education indicated that type of teacher (generalist teacher vs. specialist physical education teacher) and experience (years of teaching) influenced confidence in management and planning, with confidence then influencing intrinsic motivation, extrinsic motivation, and disengagement (Spittle et al., 2022b). In the current study, the model for students enrolled in undergraduate physical education courses indicated a similar effect, with course (Bachelor of Sport Science [Physical Education] vs. Bachelor of Education [P-12] [Primary Physical Education]) and year of course influencing confidence. Confidence also subsequently appeared to influence motivation and teaching efficacy.

4.1. Limitations

There are some limitations of the current study that should be acknowledged in interpreting the findings of this study. The study uses a cross-sectional and quantitative design, which may limit the outcomes of the study to this cohort and to the specific questions asked in the questionnaires. The study is also correlational, so we cannot ascertain causally why these relationships occur. Given that we have found relationships, further research interrogating these relationships would be valuable, particularly based on studies using more qualitative approaches to more directly consider participant perspectives of efficacy. Although the sample of 291 participants was adequate for the design, the sample used was limited to undergraduate students in two physical education courses. This could constrain the generalizability of findings to undergraduate students, so further research with post graduate groups and practicing teachers may help expand the literature.

4.2. Implications

There are several relevant implications of the results for research and for practice. The finding of lower teaching efficacy for teaching students with special needs and applying scientific knowledge indicates that these areas may be important to extend or develop in undergraduate physical education courses. Students rated intrinsic motivation for practice and extrinsic motivation for performance highest, so these are areas that many students indicated motivated them toward teaching physical education. Intrinsic motivation for practice refers to experiencing stimulating sensations of fun and excitement as motives for teaching physical education and extrinsic motivation for performance relates to choosing to teach physical education governed by restrictions or

rewards implemented by the teacher themselves rather than requirements imposed by others. Thus, emphasizing fun, enjoyment through physical education and personal responsibility for choices in physical education through physical education training and teaching may support these motives for potential physical education teachers. The gender differences in motivation did indicate different motives in physical education, with males more controlled by external sources (such as teaching physical education because it is required by the curriculum) and females more motivated by knowledge (such as teaching physical education to learn new things). Overall, the findings of the study indicated that there were significant relationships between teaching efficacy activities and confidence and motivation for teaching physical education, and that confidence appeared to have an effect on an individual's motivation to teach physical education and efficacy to teach activities in physical education a result that supports the focus on developing confidence and motivation of undergraduate physical education students to promote self-efficacy in teaching activities in physical education.

4.3. Conclusion

Students reported higher teaching efficacy for accommodating skill level differences and instruction and lower teaching efficacy for applying scientific knowledge and teaching students with special needs. Confidence in management and planning in physical education was generally high, with confidence higher in 2nd and 3rd year students than 1st year students. Motivation was generally highest in intrinsic motivation for practice and extrinsic motivation for performance and lower for intrinsic motivation for knowledge and positively was low for disengagement. Confidence and motivation were significantly related to teaching efficacy for most activities, however confidence had higher associations. Finally, motivation and confidence in teaching physical education were shown to be related to self-efficacy for a range of teaching activities in physical education, with confidence appearing to have an effect on motivation and efficacy to teach activities in physical education.

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Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Victoria University Human Research Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SS and MS co-designed the study, implemented the study, and data collection. SI conducted data management. SS, MS, and SI contributed to the initial draft. MS and SI conducted data analysis. SS, MS, and AW prepared the final draft. All authors contributed to the manuscript and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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