

## The Relationship between physical education teachers' perceived physical literacy and students' physical literacy and enjoyment of physical activity: The mediating role of teachers' self-efficacy

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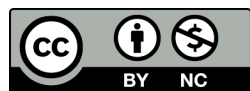
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| <p>Original Article</p> <p><b>Article history:</b><br/>Received: 21 May 2023<br/>Revised: 17 July 2023<br/>Accepted: 20 October 2023<br/>Published online: 01 January 2024</p> <p><b>Keywords:</b><br/>health literacy,<br/>physical activity,<br/>self-efficacy,<br/>structural equation<br/>modeling,<br/>students.</p> | <p><b>Background:</b> Physical education (PE) plays a crucial role in fostering an enjoyment of physical activity (PA) and developing physical literacy in students. This, in turn, contributes to lifelong health and well-being.</p> <p><b>Aim:</b> The study explored the association between teachers' perceived physical literacy, students' enjoyment of PA, and physical literacy. This was done by investigating the mediating role of teachers' self-efficacy in teaching PE.</p> <p><b>Materials and Methods:</b> The sample included 40 physical education teachers and 100 students in 7 to 9 grades of secondary education, totaling 140 participants. The teachers completed the Physical Education Teachers' Perceived Physical Literacy Instrument (PPLI) and Teacher Self-Efficacy Scale (TSES). In contrast, the students completed the Physical Activity Enjoyment Scale (PACES) and Adolescent Physical Literacy Questionnaire (APLQ).</p> <p><b>Results</b> The results from the structural equation modeling confirmed the model's fit and showed that teachers' perceived physical literacy and self-efficacy have a direct and positive relationship with students' enjoyment of PA and physical literacy. Additionally, teachers' self-efficacy indirectly mediated the relationship between teachers' perceived physical literacy and students' enjoyment of PA and physical literacy.</p> <p><b>Conclusion:</b> The results underscore the importance of teachers' perceived physical literacy in fostering positive student outcomes concerning PA by mediating the role of teaching self-efficacy.</p> |

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## 1. Introduction

The importance of Physical Education (PE) in promoting physical activity (PA) and developing physical literacy in students cannot be overstated [1]. The effectiveness of PE largely depends on the teachers, as their activities directly influence student education. A crucial factor in determining student outcomes is the physical literacy of the teacher [2]. However, the impact of teacher's physical literacy on students' enjoyment of PA and physical literacy is not fully known. This article delves into the potential role of teacher's self-efficacy in mediating this relationship.

Physical literacy encompasses more than just physical skills. It includes knowledge, understanding, motivation, confidence, and physical competence to participate in physical activities [3]. People with higher physical literacy can benefit more from the health benefits obtained through daily physical activities [4], while those with a low level of physical literacy are less likely to engage in physical activities and are often at risk of disorders and diseases [5]. Physically literate PE teachers can design engaging and effective programs that cater to diverse student abilities and create a positive learning environment that fosters enjoyment for movement [6].

Most human behaviors are driven by self-influence mechanisms. One of the most fundamental and far-reaching mechanisms of self-influence is the belief in personal self-efficacy [7]. Self-efficacy is a pivotal element of social cognitive theory and refers to an individual's assessment of their ability to succeed in specific situations. An individual's self-efficacy is shaped by external experiences and their perception of the outcomes of various conditions. Self-efficacy

also impacts an individual's motivation and accomplishments [8]. Tinning (2009) suggested that the self-efficacy of PE teachers significantly influences their professional behavior and performance [9]. Teacher self-efficacy pertains to a teacher's confidence to effectively educate students and influence their learning outcomes [10]. Teachers with high self-efficacy are more likely to employ innovative teaching methods, customize their instruction to meet student needs, and foster a positive classroom environment [11]. Building on this, Martin and Kulinna (2003) discovered that PE teachers with higher self-efficacy demonstrated greater ability to overcome obstacles, more defined intentions, and a stronger sense of control compared to those with lower self-efficacy [12].

Many factors can influence the self-confidence of PE teachers. One of these factors is the physical literacy of the teachers themselves [13, 14]. Physically literate teachers may feel more confident in their ability to create and deliver interesting lessons for students with different skill levels. They can also provide clear and effective instruction that encourages student competence and motivation. Moreover, physically literate teachers can create a safe and supportive learning environment where students feel comfortable trying new activities. This increase in self-confidence can lead to more positive experiences for students in PE, resulting in greater enjoyment of PA and improved physical literacy development [13, 15].

The policy and strategies of the British national government, titled "Sports Future: A New Strategy for an Active Nation", have incorporated physical literacy for children and adolescents. Recently, curriculum

changes in Wales have been implicitly aligned with the concept of physical literacy. PE is considered a part of the "Health and Well-Being Learning and Experience" initiative aimed at developing healthy and self-confident individuals [16]. When properly implemented, this plan can create conditions in which active children typically enjoy sports, have confidence in their PA, feel competent, and face fewer barriers to participation in sports. They understand the benefits of PA and are more likely to enjoy it, which is vital for children's PA [17].

Enjoyment is a crucial factor in motivating children and adolescents to participate in sports. Unlike adults, kids and teens consider fun and enjoyment as the main reasons for getting involved in physical activities [18]. This enjoyment refers to a positive emotional response to sports experiences, encompassing happiness, liking, and fun [19]. Research has consistently shown that enjoyment plays a vital role in motivating children to participate in sports activities. Children who regularly engage in sports tend to have a positive relationship between their enjoyment of sports and their commitment to continued participation [18]. Enjoyment of sports is a strong predictor for children and adolescents' participation in sports activities and plays a crucial role in their decision to continue participating [20]. It's important to encourage children to engage in sports and physical activities, as non-participation can lead to obesity and related health issues [21]. Additionally, the motivation to participate in physical activities and the enjoyment of these activities are influenced by the performance of PE teachers, as demonstrated in the studies of Choi et al. (2021) [14] and Lee et al. (2015) [22].

PE teachers struggle with their

perceptions of physical literacy. It can be very difficult to increase students' physical literacy in PE classes [23]. According to Sum et al. (2021), providing quality PE in school curricula increases students' outcomes [15]. Additionally, Scher and O'Reilly (2009) demonstrated that teachers' participation in educational improvement programs leads to positive changes in student behavior, attitude towards PE, and sports success in the long term [24].

There is a significant body of literature that shows a relationship between teachers' beliefs about their ability, motivation, and knowledge and their performance. In line with Bandura et al.'s (1999) [25], idea of self-efficacy beliefs increased teaching self-efficacy leads PE teachers to address many aspects of professional PE teaching, such as content knowledge, accommodating skill differences, and effective teaching [26]. In essence, teachers' self-efficacy enables them to use more challenging teaching techniques, implement innovative new programs, manage classrooms better, employ human approaches to classroom control, and promote students' independence, cognitive and emotional development, and motivation.

It seems that there is a need for further investigation into the relationship between physical literacy and the teaching self-efficacy of PE teachers. Key elements such as students' physical literacy and enjoyment of PA should be closely examined as they play a vital role in PE. Due to variations in educational systems based on political, social, cultural, and economic factors, there is a lack of research on the impact of teaching self-efficacy and physical literacy of PE teachers on students' physical literacy and enjoyment of PA in the context of Iran. Previous studies in this area have primarily

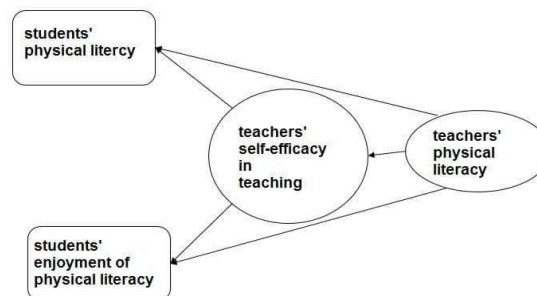
focused on teachers' participation in training sessions [13, 14, 15, 23]. While some studies have explored the effect of teachers' self-efficacy on students' physical literacy and enjoyment of sports [10, 11, 12, 27], no research has been conducted to model the relationship between these variables using structural equation modeling. Given the recent emergence of physical literacy in Iran, it is crucial to study this aspect further. This study aimed to examine the relationship between physical literacy and teaching self-efficacy of PE teachers and students' physical literacy and enjoyment of PA. The study hypothesizes that improving physical literacy will enhance teachers' self-efficacy in teaching PE and, in turn, improve students' physical literacy and enjoyment of PA. Ultimately, this will lead to the development of efficient PE teachers who can facilitate increased pleasure in PA among their students.

The study's novelty lies in examining the important connections between various variables related to physical literacy and PE teaching using structural equation modeling. Based on the theoretical foundations related to physical literacy [28], this study looks at how PE teachers' teaching self-efficacy and the connection between perceived physical literacy and students' enjoyment of PA impact the teaching performance of PE teachers [14, 23]. Therefore, the goal of this study is to model the relationships between these variables (Figure 1) using confirmatory factor analysis based on structural equation modeling to understand the complex relationships among these variables.

## 2. Materials and Methods

### 2.1. Participation

The research is a descriptive correlational study conducted using the structural equation modeling method.



**Figure 1.** The assumed schematic model of the relationship between research variables

The study's statistical population includes all PE teachers and students in the cities of Tehran province. Different recommendations have been made for selecting the sample size for implementing structural equation modeling in various studies, including a minimum sample size of 100 or 200 samples [29] and the selection of 5 or 10 samples for each variable under study [30]. As this study investigates four variables, 40 male and female PE teachers with at least 10 years of experience in teaching PE at schools (mean age:  $38.9 \pm 3.78$  years) were selected as a statistical sample. Additionally, 100 male and female students in grades 7 to 9 (12-15 years old), who were the students of these teachers, were involved in the study. In total, 40 PE teachers and 100 students, making a total of 140 participants, took part in the study after completing the consent form.

### 2.2. Instrument

The Perceived Physical Literacy Instrument (PPLI) was used as the data collection tool. It is a scale designed to measure PE teachers' perception of their physical literacy, including their sense of self and self-confidence, self-expression and communication with others, and knowledge and understanding [31]. The instrument

consists of a 9-question questionnaire with dimensions of self-feeling and self-confidence (3 items), self-expression and communication with others (3 items), and understanding and knowledge (3 items). This questionnaire uses a five-point Likert scoring method: completely disagree (score 1), disagree (score 2), have no opinion (score 3), agree (score 4), and completely agree (score 5), with a minimum score of 9 and a maximum score of 45. In a study by Samadi et al. (2023), the comparative fit index was higher than 0.9. Additionally, a Cronbach's alpha coefficient for perceived physical literacy and its dimensions above 0.7 was obtained, indicating good validity and reliability of the questionnaire in a local study [32].

The Teacher Self-Efficacy Scale (TSES) by Tschannen-moran and Hoy (2001) was used to measure teachers' self-efficacy [33]. This scale consists of 24 items and 3 subscales: inclusive involvement (7 items), educational strategies (9 items), and classroom management (8 items). These subscales are used to measure teacher self-efficacy. The questionnaire is scored using a 5-point Likert scale, with 1, 2, 3, 4, and 5 scores representing "very little", "low", "somewhat", "much", and "very much" respectively. In a study by Hosseinchari et al. (2011), the total reliability of this scale was calculated as 0.83 using Cronbach's alpha method, indicating high reliability [34].

The Physical Activity Enjoyment Scale (PACES) developed by Moore et al. (2009) was used to assess students' enjoyment of PA [35]. This scale consists of 16 items and is designed to measure the enjoyment of PA in children aged 12 to 16 years. Each item in the questionnaire is rated on a five-point Likert scale, ranging from completely disagree to agree, with scores from one to five,

respectively. Seven items (items 2, 3, 5, 7, 12, 13, and 16) are scored negatively, while the remaining items are scored positively. In a study by Mokaberian et al. (2018), the suitability indices for Ramzi's method were found to be 0.05, with CFI at 0.92 and NNFI at 0.9 [36]. Additionally, Cronbach's alpha coefficient was 0.83, indicating good internal consistency, and the intra-class correlation coefficient for temporal reliability was 0.8, both considered acceptable values. The findings from the study also provide support for the single-factor structure and 16 questions of the main scale.

In the study, the Adolescent Physical Literacy Questionnaire (APLQ) developed by Mohammadzade et al. (2022) was utilized to assess students' physical literacy. This questionnaire consists of 25 items and measures the cognitive capacities (7 items), psychological capacities (11 items), and physical capacities (7 items) related to physical literacy. All items in the questionnaire are rated on a five-point Likert scale. They reported good internal consistency ( $\alpha= 0.951$ ), retest reliability (0.981–0.837), and concurrent validity of the questionnaire with the PPLI instrument (0.680–0.790) for the 12 to 18-year-old population, indicating the validity and reliability of the questionnaire for this age group [37].

### 2.3. Procedure

First, the PE teachers from public and non-government schools who meet specific criteria, such as completing the informed consent form and being employed at one of the public or non-government schools at the time of the study, will be identified. Each PE teacher will then be asked to invite 10 students to participate in the study. The PE teachers will be given a set of questionnaires,

including PPLI and TSES to complete. The students will also be asked to complete the PACES and APLQ. Once the questionnaires are completed, the data will be collected and analyzed. The average scores of the 10 students for each variable in the questionnaires will be recorded as one score for each teacher during the data analysis.

#### 2.4. Statistic

The research data was analyzed using "SmartPLS.3" software. To ensure the validity and reliability of the questionnaires, statistical methods were employed. The measurement model was initially assessed to determine the reliability and validity of the constructs and measurement tools. Three methods were utilized to evaluate the reliability of constructs: factor loading of each item, composite reliability of each construct, and average variance extracted (AVE). According to Fornell and Larcker (1981), factor loadings equal to or greater than 0.6 for each item indicate a good structure [38]. Additionally, the Dillon-Goldstein coefficient or the composite reliability of the constructs should exceed 0.7 to confirm validity. To establish the differential validity of the constructs, Fornell and Larcker recommended comparing the average square root of the AVE of each variable with the correlation of that variable with other variables [38]. The correlation of each hidden variable and its indicators should be higher than the correlation of that variable with other variables. The Goodness of Fit (GOF) of the structural model with the PLS method was examined using R Squares or R2 coefficients and Q2 criteria. Moreover, the proposed criterion of Tenenhaus et al. (2004) was employed to assess the overall model fit, encompassing both the measurement and

structural model parts, through the GOF criterion using Equation (1) [39].

$$GOF = \sqrt{(\overline{communality}) \times (\overline{R^2})} \quad (1)$$

Considering the above relationship, first, the average values of the shared values (*communality*) of the hidden variables of teachers' perceived physical literacy and teachers' self-efficacy were calculated.

In the PLS method, the data analysis algorithm is used to check the fit of the measurement, structural, and general models. This involves examining the significant Z coefficients (t values) of each path and the standardized factor loading coefficients related to the paths to test the research hypotheses. If the significance coefficient of each path is greater than 1.96, the path is confirmed at a 95% confidence level, and the related hypothesis is confirmed.

### 3. Results

The factor loadings for each item can be found in Table 1. Upon reviewing the results, it is evident that the factor loadings of the items have appropriate values.

The values obtained for the Dillon-Goldstein coefficient or the composite reliability in Table 2 also indicate the acceptable reliability of the structures. The third index for reliability is AVE. The criterion value for the acceptance level of the AVE is 0.5 [38]. As shown in Table 2, it is evident that the AVE of the variance related to the constructs is suitable. This means that a latent variable can explain more than half of the dispersion of its indicators on average, indicating the acceptable convergent validity of the current research model.

**Table 1.** Factor loadings of measurement tools items

| Teachers PPL |                | Teachers self-efficacy |                | Students PL |                | Student enjoyment of PA |                |
|--------------|----------------|------------------------|----------------|-------------|----------------|-------------------------|----------------|
| Items        | Factor loading | Items                  | Factor loading | Items       | Factor loading | Items                   | Factor loading |
| T-pl1        | 0.807          | T-s1                   | 0.786          | S-p1        | 0.868          | S-e1                    | 0.855          |
|              |                | T-s2                   | 0.799          | S-p 2       | 0.865          | S-e2                    | 0.746          |
| T-pl2        | 0.823          | T-s3                   | 0.806          | S-p 3       | 0.931          | S-e3                    | 0.812          |
|              |                | T-s4                   | 0.786          | S-p 4       | 0.891          | S-e4                    | 0.894          |
| T-pl3        | 0.856          | T-s5                   | 0.808          | S-p 5       | 0.835          | S-e5                    | 0.853          |
|              |                | T-s6                   | 0.797          | S-p 6       | 0.865          | S-e6                    | 0.868          |
| T-pl4        | 0.823          | T-s7                   | 0.809          | S-p 7       | 0.854          | S-e7                    | 0.878          |
|              |                | T-s8                   | 0.790          | S-p 8       | 0.886          | S-e8                    | 0.848          |
| T-pl5        | 0.818          | T-s9                   | 0.797          | S-p 9       | 0.836          | S-e9                    | 0.897          |
|              |                | T-s10                  | 0.796          | S-p10       | 0.882          | S-e10                   | 0.843          |
| T-pl6        | 0.815          | T-s11                  | 0.789          | S-p11       | 0.851          | S-e11                   | 0.869          |
|              |                | T-s12                  | 0.824          | S-p12       | 0.868          | S-e12                   | 0.845          |
| T-pl7        | 0.810          | T-s13                  | 0.814          | S-p13       | 0.897          | S-e13                   | 0.793          |
|              |                | T-s14                  | 0.797          | S-p14       | 0.814          | S-e14                   | 0.864          |
| T-pl8        | 0.797          | T-s15                  | 0.846          | S-p15       | 0.917          | S-e15                   | 0.889          |
|              |                | T-s16                  | 0.803          | S-p16       | 0.896          | S-e16                   | 0.724          |
| T-pl9        | 0.818          | T-s17                  | 0.775          | S-p17       | 0.876          |                         |                |
|              |                | T-s18                  | 0.834          | S-p18       | 0.901          |                         |                |
|              |                | T-s19                  | 0.807          | S-p19       | 0.728          |                         |                |
|              |                | T-s20                  | 0.807          | S-p20       | 0.861          |                         |                |
|              |                | T-s21                  | 0.806          | S-p21       | 0.755          |                         |                |
|              |                | T-s22                  | 0.797          | S-p22       | 0.762          |                         |                |
|              |                | T-s23                  | 0.792          | S-p23       | 0.901          |                         |                |
|              |                | T-s24                  | 0.771          | S-p24       | 0.883          |                         |                |
|              |                |                        |                | S-p25       | 0.851          |                         |                |

**Table 2.** Reliability test of measurement tools

|                          | Composite reliability | Cronbach Alpha | AVE   |
|--------------------------|-----------------------|----------------|-------|
| Teachers PPL             | 0.948                 | 0.939          | 0.670 |
| Teachers self-efficacy   | 0.977                 | 0.976          | 0.642 |
| Students enjoyment of PA | 0.975                 | 0.973          | 0.712 |
| Students PL              | 0.986                 | 0.986          | 0.745 |

To assess the validity of the constructs, we used Fornell and Larcker's (1981) criterion, also known as differential validity [38]. The root mean AVE is presented at the end of each row in Table 3. The values of each variable are higher than the correlation of each variable with other variables, indicating the acceptable validity of the measurement tools.

To examine GOF of the structural model with the PLS method, R Squares or  $R^2$  coefficients and  $Q^2$  criteria are used. The values of  $R^2$  and  $Q^2$  for the model structures are given in Table 4. The  $R^2$  values of the endogenous structures indicate the model fit, with higher values representing a better fit. Table 4 confirms the appropriateness of the model fit for the structural model.

**Table 3.** Correlation matrix of research variables and square root of AVE

| Variables               | 1           | 2           | 3           | 4           |
|-------------------------|-------------|-------------|-------------|-------------|
| Teachers' self-efficacy | <b>0.80</b> |             |             |             |
| Student PL              | 0.65        | <b>0.86</b> |             |             |
| Teacher PPL             | 0.67        | 0.63        | <b>0.81</b> |             |
| Student enjoyment of PA | 0.57        | 0.73        | 0.63        | <b>0.84</b> |

*P*<0.01

**Table 4.** R<sup>2</sup> & Q<sup>2</sup> values of model constructs

| Construct      | Teacher PPL | Teacher self-efficacy | Student enjoyment of PA | Student PL |
|----------------|-------------|-----------------------|-------------------------|------------|
| R <sup>2</sup> | –           | 0.459                 | 0.446                   | 0.492      |
| Q <sup>2</sup> | 0.442       | 0.521                 | 0.476                   | 0.455      |

Additionally, higher Q<sup>2</sup> values for the endogenous structures reflect better predictive power of the model. After assessing the model fit for the measurement and structural parts, the overall model fit is examined. The average shared values (*communality*) of the hidden variables for teachers' perceived physical literacy and self-efficacy are 0.442 and 0.521, respectively (Table 4). Thus, the average shared value is 0.481.

To calculate the average coefficient of determination ( $\overline{R^2}$ ), the values related to all latent endogenous variables of the model, i.e. teachers' perceived physical literacy, teachers' self-efficacy, students' physical literacy, and students' enjoyment of PA (Table 4) should be considered and their average values should be calculated. The coefficient values of the mentioned variables are 0.000, 0.459, 0.446, and 0.492, respectively. Therefore, the average of these values is equal to 0.349. Finally, the GOF of the model is as Equation (2).

$$GOF = \sqrt{(\overline{communality}) \times \overline{R^2}} = 0.409 \quad (2)$$

As a result, the value of the GOF criterion is equal to 0.409, which shows the

strong overall fit of the model considering the three values of 0.01, 0.25, and 0.36 as weak, medium, and strong values for GOF [40].

In the tested conceptual model, Figure 2 displays the output of the t coefficients. The predicted paths for teachers' perceived physical literacy to students' enjoyment of PA, students' physical literacy, teachers' self-efficacy to students' enjoyment of PA, and students' physical literacy are significant at the 95% confidence level. After standard estimation, the cause-and-effect relationship between the research constructs was examined. Figure 3 confirms the relationships between teachers' perceived physical literacy and students' enjoyment of PA, students' physical literacy, and teachers' self-efficacy, as well as the relationship between teachers' self-efficacy and students' enjoyment of PA and students' physical literacy because their significant numbers are not between +1.96 and -1.96.

In summary, Figures 2 and 3 reveal that teachers' perceived physical literacy has a direct, positive, and significant relationship with students' enjoyment of PA (t=4.78; β=0.20), and teachers' perceived physical literacy has a direct, positive, and significant relationship with students' physical literacy (t=3.96; β=0.13).



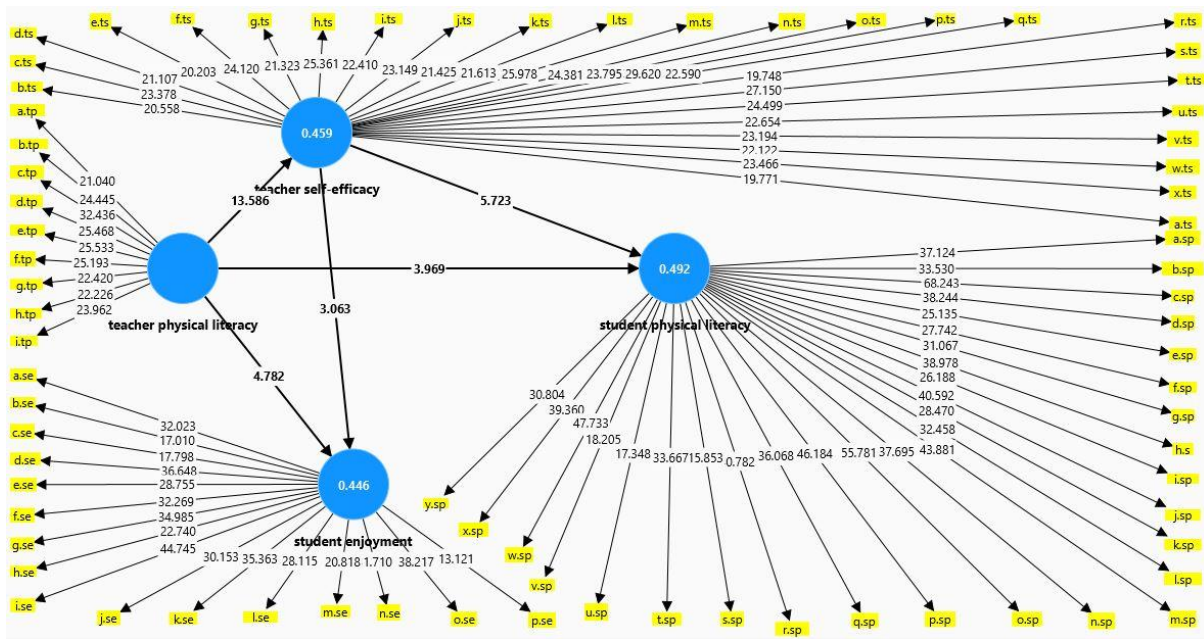


Figure 2. Implementation of the model in a meaningful mode

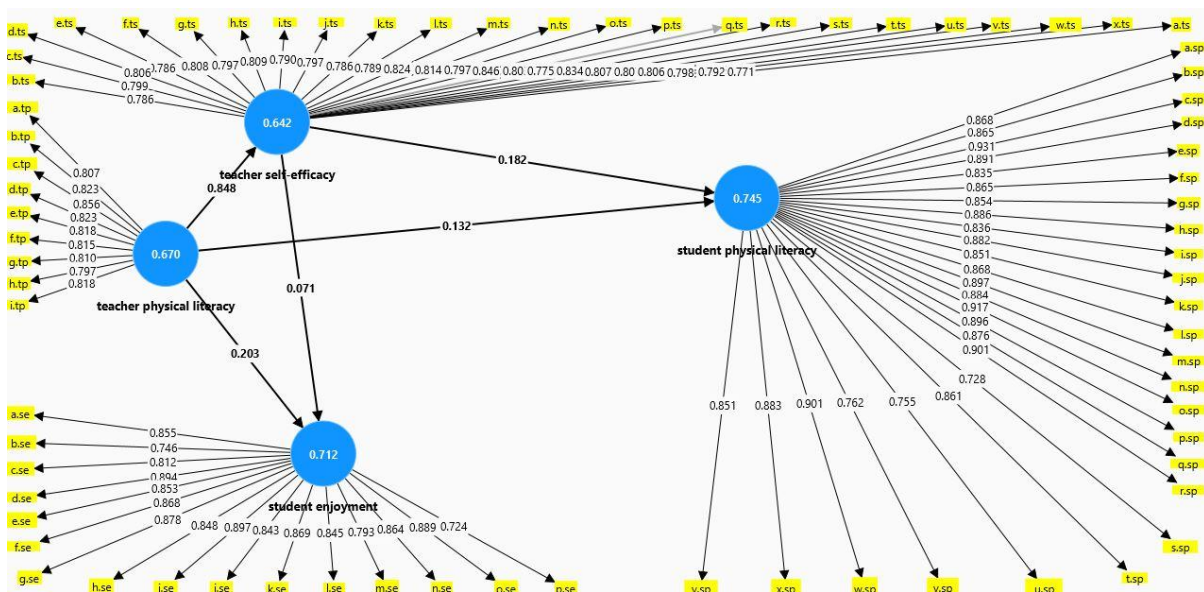


Figure 3. Running the model in standard estimation mode

Teachers' perceived physical literacy has a direct, positive, and significant relationship with teachers' self-efficacy ( $t=13.58$ ;  $\beta=0.84$ ). Teachers' self-efficacy has a direct, positive, and significant relationship with students' enjoyment of PA ( $t=3.06$ ;  $\beta=0.07$ ). Teachers' self-efficacy has a direct, positive, and significant relationship with physical literacy ( $t=5.72$ ;  $\beta=0.18$ ). Teachers'

perceived physical literacy with the mediating role of teachers' self-efficacy has an indirect, positive, and significant relationship with students' physical literacy ( $t=5.2$ ;  $\beta=0.28$ ). Teachers' perceived physical literacy with the mediating role of teachers' self-efficacy has an indirect, positive, and significant relationship with students' enjoyment of PA ( $t=3.04$ ;  $\beta=0.18$ ).

#### 4. Discussion

PE teachers play a significant role in implementing educational curriculum policy, which can greatly influence students' physical literacy [27]. However, the link between PE teachers' perceived physical literacy and student outcomes needs further investigation. This study examined the connection between PE teachers' perceived physical literacy and self-efficacy and students' physical literacy and enjoyment of PA. Data from 40 PE teachers and 100 students were analyzed using structural equation modeling. The results strongly supported the hypothesized relationships and overall model fit. The measurement model demonstrated reliability and validity, indicating that the measures accurately captured the intended constructs. The structural model fit indices also indicated a good fit, suggesting an effective explanation of the relationships between the variables.

The findings of this study support previous research showing how important PE teachers are in promoting student physical literacy. Studies have demonstrated that teachers who possess strong physical literacy knowledge and skills are better at creating activities that are appropriate for students' development, encouraging positive attitudes toward PA, and providing supportive learning environments that meet the needs of diverse students [3, 13, 14, 15, 23]. This study reinforces this idea by showing that when PE teachers have high levels of perceived physical literacy, it positively impacts student physical literacy and enjoyment by boosting teachers' confidence in teaching PE.

Several studies have examined teacher self-efficacy [10, 11, 12, 27], but there is limited research on PE teacher self-efficacy

in teaching. However, the research that has been done in this area suggests a positive relationship between self-efficacy and the implementation of specific teaching tasks and styles [12]. For example, Martin and Kulinna (2003) found that PE teachers who felt confident in providing high levels of PA to their students were more likely to support program goals such as promoting PA, fitness, and health, compared to teachers who felt less confident in teaching PA [12]. This confidence is linked to the physical literacy of the PE teacher. When a PE teacher possesses a good understanding of physical literacy, they are better able to promote PA, fitness, and good health, and use appropriate teaching methods to improve the physical and psychological well-being of students [28].

Furthermore, according to self-efficacy theory, individuals who interpret their bodily or mood reactions to a situation as signs of their capability are more likely to have higher self-efficacy. On the other hand, those who perceive such reactions as signs of stress or inefficiency are more likely to doubt their abilities and avoid challenging situations [25]. Therefore, a teacher with high physical literacy feels competent, has higher motivation, and enhances their knowledge and awareness for effective teaching, leading to increased self-efficacy in teaching PE.

As a result, since the concept of physical literacy serves as the foundation for teaching healthy lifestyles to students, the students implicitly benefit from their teacher's expertise in various aspects of physical literacy. Additionally, the PE teacher serves as a strong role model for students, not only in sports but also in everyday behavior and activities. The PE teacher introduces the concept of healthy living, which is easily

grasped during PE classes and throughout the school day [41]. It's important to recognize that a teacher with high physical literacy is more motivated and energetic, capable of providing diverse teaching methods and creating an environment rich in physical activities related to students' physical literacy. Research has shown that physical literacy intervention can positively impact students' skills, confidence, and various aspects of physical literacy [23]. This intervention has been implemented in various countries with promising results.

Teachers who are responsible for providing PA need to understand the concept of physical literacy to deliver quality PE. This understanding is necessary to help students generate innovative ideas, assist others, and develop respect for the environment [42]. It is essential to introduce early physical literacy experiences to PE teachers, as this helps them develop positive values and beliefs about physical literacy [41]. To teach students the various aspects of physical literacy, teachers need to have certain "non-negotiable" characteristics, including a theoretical understanding of philosophy and a teaching model with a distinct identity [4]. The quality of teaching and learning, as well as the enjoyment and participation in PA, is not solely determined by the cognitive and physical dimensions of the teacher's physical literacy. The psychological characteristic of the PE teacher, known as teaching self-efficacy, can also play a significant role in the effectiveness of PE teaching and training [27]. This impact is not limited to the performance and grades of the PE course but also affects student participation, enjoyment of PA, and various levels of physical literacy.

The current study demonstrated that a PE

teacher's physical literacy is significantly correlated with students' physical literacy and enjoyment of PA. Additionally, the study found a direct relationship between physical literacy and the self-efficacy of PE teachers. Moreover, it was indirectly confirmed that the self-efficacy of PE teachers affects students' physical literacy and enjoyment of PA. In essence, the teaching self-efficacy of PE teachers plays a mediating role in connecting the teacher's physical literacy with the student's physical literacy and enjoyment of PA. This indicates that a PE teacher with a strong grasp of physical literacy possesses the knowledge, self-confidence, motivation, and suitable understanding of optimal PA. This, in turn, creates an environment rich in diverse PAs that are beneficial to students' health. Exposure to a variety of PAs leads to increased enjoyment and greater participation. When students are exposed to a broad range of PAs, they engage in physical activities with heightened motivation, leading to increased motor competence and a sense of satisfaction. The pleasure derived from participating in PA is a result of the PE teacher's physical literacy, which enables the creation of an enjoyable environment that aligns with the overarching concept of physical literacy [13, 15, 23].

This study has limitations due to its small sample size and cross-sectional design. To enhance the generalizability and draw more precise causal inferences from the findings, future research should use larger and more diverse samples and employ longitudinal designs. Additionally, future research could further investigate how pre-service and in-service professional development programs can best enhance PE teacher physical literacy, thus ensuring that all teachers have

the requisite knowledge and skills to empower students for lifelong PA.

## 5. Conclusion

The findings of this study indicate that teachers' perceived physical literacy has a positive and significant direct impact on student's physical literacy and enjoyment of PA. Moreover, teachers' self-efficacy plays a partial mediating role in the relationship between teachers' perceived physical literacy and students' physical literacy and enjoyment of PA. These results underscore the importance of teachers' perceived physical literacy and self-efficacy in fostering positive student outcomes concerning PA. Consequently, it is recommended that the Ministry of Education prioritize teachers' comprehension of physical literacy in education to enhance both the level of physical literacy and the enjoyment of PA among students. Future research could further investigate additional factors influencing students' physical literacy and enjoyment of PA, and explore the long-term effects of PE teacher physical literacy on student health and well-being.

## Conflict of interest

The authors declared no conflicts of interest.

## Authors' contributions

All authors contributed to the original idea, study design.

## Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

## Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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