Hacettepe Üniversitesi Eğitim Fakültesi Dergisi

Hacettepe University Journal of Education

e-ISSN: 2536-4758

Pre-service Physical Education Teachers' Teacher Identity Scale (PPET-TI): Adaptation Study to Turkish Culture*

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Article Information

Received: 27.05.2025

Accepted: 20.11.2025

Online First: 17.01.2026

Published: 31.01.2026

ABSTRACT

In Turkey, the lack of measures for assessing the teacher identity of pre-service physical education teachers remains a significant challenge. Developing quantitative instruments grounded in a robust theoretical framework is crucial, as such tools would not only advance research in this field but also contribute to improving the quality of physical education teacher education. This study aims to test the reliability and validity of the Pre-service Physical Education Teachers' Teacher Identity Scale (PPET-TI) to Turkish pre-service physical education teachers. The PPET-TI is a 7-point Likert-type scale comprising 17 items and three subscales: self-definitions, teaching goals, and professional responsibilities. Two hundred fifty pre-service physical education teachers (96 females and 154 males; $\bar{x}_{age}$ = 21.25±2.36) voluntarily participated in the study. Confirmatory Factor Analysis (CFA) and Exploratory Structural Equation Modeling (ESEM) were conducted to evaluate the construct validity. The results of the CFA indicated that S-Bχ^2/df 1.90, CFI 0.95, TLI 0.94, RMSEA 0.06, and SRMR 0.05. The results of the ESEM indicated that S-Bχ^2/df 2.79, CFI 0.98, TLI 0.97, RMSEA 0.08, and SRMR 0.03. The item factor loadings ranged from 0.58 to 0.97 in the CFA and ranged from 0.45 to 0.82 in the ESEM. The findings indicated that the scale exhibited both discriminant and convergent validity, with CR and Cronbach's alpha being strong. An evaluation of the fit indices, item factor loadings, and inter-item relationships revealed that the CFA results were more consistent with the original structure of the scale. Based on all the findings, it can be concluded that the Turkish version of the scale is suitable for assessing the teacher identities of pre-service physical education teachers.

Keywords: Pre-service physical education teachers, teacher identity scale, professional identity

doi: 10.16986/hunefd.1707014 Article Type: Research Article

Citation Information: Sönmez, H. O., Aşçı, F. H., & Mirzeoğlu, A. D. (2026). Pre-service physical education teachers' teacher identity scale (PPET-TI): Adaptation study to Turkish culture. *Hacettepe University Journal of Education, 41*(1), 44-55. https://doi.org/10.16986/hunefd.1707014

1. INTRODUCTION

As the world population has grown, the school-age population has also increased. Despite the increasing need for new teachers (Heffernan & Newton, 2019), enrollment in teacher education programs has declined (U.S. Department of Education, 2019). Moreover, many prospective teachers seem reluctant to make a full commitment to the teaching profession (Berry & Shields, 2017). Consequently, it is essential to analyze the factors that affect the career choices of individuals pursuing a career in education (Ferry, 2018; Liu & Keating, 2022).

The career choices of pre-service teachers are significantly influenced by the teacher identity they cultivate during their pre-service education (Adams et al., 2006; Hong, 2010). Teacher identity can be defined in several ways, such as a state associated with the teaching profession (Lawler, 2015), a pathway toward becoming a teacher (Beijaard et al., 2004), a sense of belonging within the teaching community (Adams et al., 2006), and an ongoing process of acquiring practical knowledge about teaching on both individual and collective levels (Beijaard et al., 2004). Additionally, it involves a teacher's development to

* Ethical clearance was obtained from the Ethics Committee of Sakarya University of Applied Sciences on 14 June 2024 (Ethics Approval Number: E-26428519-050.99-129839).

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align self-images with contextual expectations (Trede et al., 2012). Pre-service teachers with a strong professional identity often demonstrate enhanced professional skills, prioritize their personal development, and maintain positive attitudes towards educational settings (Beijaard et al., 2004). They also report higher life satisfaction and lower anxiety about the future (Wang et al., 2011). The strength of teachers' professional identity is positively associated with their enthusiasm for teaching and negatively associated with feelings of burnout and intentions to quit (Luo et al., 2014).

Although there is increasing research on teacher identity, studies specifically focusing on the identities of pre-service physical education teachers are still limited (Liu & Keating, 2022). Keating et al. (2017) conducted a systematic review of 14 empirical studies and found that the research in this area is still new. They highlighted the absence of diversity in ontological and epistemological perspectives, as well as in research methodologies, along with a scarcity of quantitative studies. Furthermore, they highlighted the need for valid and reliable measures within this field. The literature review reveals that qualitative research in this field has frequently employed narrative approaches (A da Cunha, 2014; Devís-Devís & Sparkes, 1999; Margarida et al., 2012) and case study designs (Devís-Devís & Sparkes, 1999; MacDonald et al., 1998; MacDonald & Kirk, 1999; Margarida et al., 2012). In recent years, there has been a growing emphasis on quantitative research, particularly in the development of teacher identity measures. For example, Çalı and Doğar (2024) and Zhou et al. (2012) developed for assessing the teacher identity of physical education teachers. In addition, Zhang (2017) developed a scale specifically designed for physical education pre-service teachers, drawing on prior theory-driven research. This scale was later validated by Yang et al. (2023) with pre-service physical education teachers in China. Additionally, Liu and Keating (2022) developed a scale specifically for physical education pre-service teachers, grounding it in the Dynamic Systems Model of Role Identity (DSMRI), which provides a meta-theoretical foundation for understanding role identity. In the Turkish context, existing teacher identity scales have limited capacity to capture the multidimensional and developmental nature of identity among pre-service teachers, particularly within subject-specific domains such as physical education. Although several instruments have been developed to assess general aspects of teacher identity, these primarily reflect a broad professional self-concept rather than the subject-specific, practical, and embodied dimensions that characterize physical education teaching (e.g., Arpacı & Bardakçı, 2015; Aydın & Aslan, 2024). Addressing these limitations, the adaptation of a teacher identity scale for Turkish pre-service physical education teachers is expected to fill an important methodological and contextual gap by providing a theoretically grounded, psychometrically sound, and culturally relevant tool for examining teacher identity within a specific disciplinary and developmental framework.

When the scales above are examined, two theoretically grounded scales developed for pre-service physical education teachers stand out (e.g., Zhang, 2017; Liu & Keating, 2022). Overall, both scales were developed to assess PPET-TI across different domains. The overlapping domains included expectations and professional goals related to teaching physical education, as well as current self-perceptions as a PE teacher, future intentions, and actual teaching behaviors. These shared dimensions provide valuable insights for advancing quantitative research on PPET-TI in both Chinese and English contexts. Despite their shared purpose, the two psychometric instruments differ in several respects. The scale developed by Liu and Keating (2022) in the United States was explicitly grounded in the dynamic systems model of teacher identity, offering a direct theory-driven framework. In contrast, the Chinese scale developed by Zhang (2017) was not directly grounded in a theoretical framework, but rather was indirectly based on prior theory-driven research. The PPET-TI developed by Liu and Keating (2022) was based on the meta-theoretical framework of DSMRI, which is why its adaptation to Turkish culture was preferred.

The DSMRI model, developed by Kaplan et al. (2015), effectively combines the strengths of both structural and socio-cultural approaches to better understand the development and formation of teacher identity, while also addressing their limitations. The structural approach employs quantitative methods to assess changes, yielding empirical findings (Butler, 2007; Richardson & Watt, 2010; Roth, 2014). Conversely, the socio-cultural approach examines the holistic and subjective meanings of teacher identity within specific contexts, using qualitative methods to clarify processes of teacher transformation (Beauchamp & Thomas, 2009; Horn et al., 2008). The DSMRI model comprises four independent components: self-perceptions and definitions, ontological and epistemological beliefs, goals and purposes, and perceived action possibilities. The model integrates all four components into a cohesive structure, distinguishing itself from other frameworks by connecting them to a specific context rather than focusing on only one or two dimensions of teacher transformation. Liu and Keating (2022) developed the scale by creating interview questions that represented the four components of the DSMRI, followed by a qualitative study to identify emerging themes. From these themes, scale items were developed, and a subsequent quantitative study was conducted to establish the validity and reliability of the scale.

The scale developed by Liu and Keating (2022) has not previously been adapted to a different cultural context. The validation and reliability testing of measurement instruments used in teacher education research across different cultural contexts is of critical importance for the scientific rigor of the data obtained. Scales designed to measure culturally sensitive variables such as teacher identity, professional self-efficacy, or pedagogical approaches are shaped by the values and norms of the cultural context in which they were developed, which often limits their direct use in other cultures (Hambleton & De Jong, 2003). For this reason, adapting foreign scales to the different contexts is not merely a linguistic translation process, but rather a multidimensional procedure in which intercultural differences are carefully considered, and conceptual as well as structural equivalence is ensured (Van de Vijver & Leung, 2021). The unique socio-cultural structure of Turkey differentiates pre-service teachers' professional development experiences and teacher identity, making cultural adaptation essential for the valid use of

such scales. Consequently, considering intercultural differences and adapting this scale into the Turkish culture strengthens both the scientific reliability of measurements and the contextual understanding of pre-service teachers' professional identity.

This scale can provide valuable contributions to teachers, academics working in teacher education, and pre-service teachers. In this regard, significant steps can be taken toward preparing physical education pre-service teachers with a strong teacher identity, and such efforts may also support pre-service teachers in their career choices. The scale can also facilitate longitudinal studies, enabling researchers to track changes in teacher identity over time and to gain deeper insights into its development within teacher education programs. Furthermore, it may serve as a foundation for quasi-experimental studies evaluating the impact of teacher education courses and practices on teacher identity. Ultimately, these efforts will contribute to enhancing the overall quality of teacher education programs.

1.2. Purpose of the Study

This study aimed to test the reliability and validity of the PPET-TI developed by Liu and Keating (2022) to fit the Turkish cultural context. In line with this objective, the study sought to answer the following research questions:

1. Is PPET-TI reliable and valid for measuring the teacher identity of Turkish physical education pre-service teachers?
2. Have CFA or ESEM provided better results in the adaptation of PPET-TI to Turkish culture?

2. METHODOLOGY

2.1. Participants

The convenience sampling method was used to select participants. The study involved 250 participants, including 96 females ($\bar{x}_{age}$= 20.74 ± 1.88) and 154 males ($\bar{x}_{age}$= 21.57 ± 2.56), resulting in an overall mean age of 21.25 ± 2.36 years. The sample was selected from different grade levels since diversifying the sample by grade level enhances the generalizability and cultural validity of the scale (Hambleton & De Jong, 2003), and teacher identity develops across educational stages (Beijaard et al., 2004). 60 (24%) of the participants were in the 1st grade, 85 (34%) were in the 2nd grade, 53 (21.2%) were in the 3rd grade, and 52 (20.8%) were in the 4th grade. Data were collected during the 2023–2024 academic year from male and female students enrolled in physical education and sports teaching programs at universities in the Marmara Region. This decision was based on both practical and methodological considerations. In cross-cultural scale adaptation studies, it is common to begin with more accessible and homogeneous samples to establish preliminary evidence of validity and reliability before extending research to larger and more diverse populations (Beaton et al., 2000; Hambleton & Patsula, 1999). Conducting the initial validation with a manageable group ensured close monitoring of the adaptation process, minimized contextual confounds, and allowed for more controlled evaluation of the factorial structure. Furthermore, as argued by DeVellis and Thorpe (2021), scale development and adaptation often follow a stepwise process in which initial studies are necessarily limited in scope but provide the foundation for broader applications. In scale development and validation studies, a sample size of at least 200 participants or 5 to 10 participants per scale item is recommended (Brown, 2015).

2.2. Instrument

Pre-service Physical Education Teachers' Teacher Identity Scale (PPET-TI):

The scale was developed by Liu and Keating (2022) using the DSMRI, which provides a meta-theoretical approach to understanding identity (Kaplan & Garner, 2017). The items were evaluated using a 7-point Likert scale for responses. The scale consists of 17 items and three subscales: self-definitions (four items total, including one reverse-coded item), teaching goals (eight items), and professional responsibilities (five items). *Self-definitions* indicate a pre-service physical education teacher's ability to envision themselves as future physical education teachers and plan their careers in physical education instruction (e.g., I see myself as a future physical education teacher). *Teaching goals* indicate the degree to which a pre-service physical education teacher is likely to commit time and effort to achieving physical education standards (e.g., Teaching knowledge and skills of living a physically active lifestyle). *Professional responsibilities* highlight the likelihood a pre-service physical education's engaging in professional development activities aimed at personal growth and enhancing school-based physical education programs (e.g., Attend professional development learning opportunities related to physical education). Responses range from 1 (strongly disagree) to 7 (strongly agree) for the self-definitions subscale and from 1 (extremely unlikely) to 7 (extremely likely) for the teaching goals and professional responsibilities subscales. The use of different response formats across sub-dimensions is grounded in the nature of the construct being measured; while agreement-based formats are more appropriate for assessing attitudes or beliefs, likelihood formats are considered more valid for capturing future behavioral tendencies (DeVellis & Thorpe, 2021; Krosnick & Fabrigar, 1997). The average scale score is used to evaluate teacher identity strength, with higher scores signifying a stronger teacher identity (Liu & Keating, 2022).

The confirmatory factor analysis (CFA) showed acceptable fit indices (χ^2=273.57, RMSEA=0.05, CFI=0.97, TLI=0.96, SRMR=0.06) for the three-factor structure of the scale. All factor loadings were greater than 0.57 and found to be statistically significant at the $p<0.001$ level. The Average Variance Extracted (AVE) values ranged between 0.62 and 0.64, and the

Composite Reliability (CR) values between 0.86 and 0.97. Regarding criterion validity, the scale demonstrated a positive correlation with professional commitment and a negative correlation with leaving the teaching profession. The Cronbach's alpha values vary from 0.84 to 0.93, demonstrating a strong internal consistency (Liu & Keating, 2022).

2.3. Translation Procedure

The translation procedure was conducted using the standard method of translation and back translation as proposed by Brislin (1986) and Beaton et al. (2000) (Figure 1).

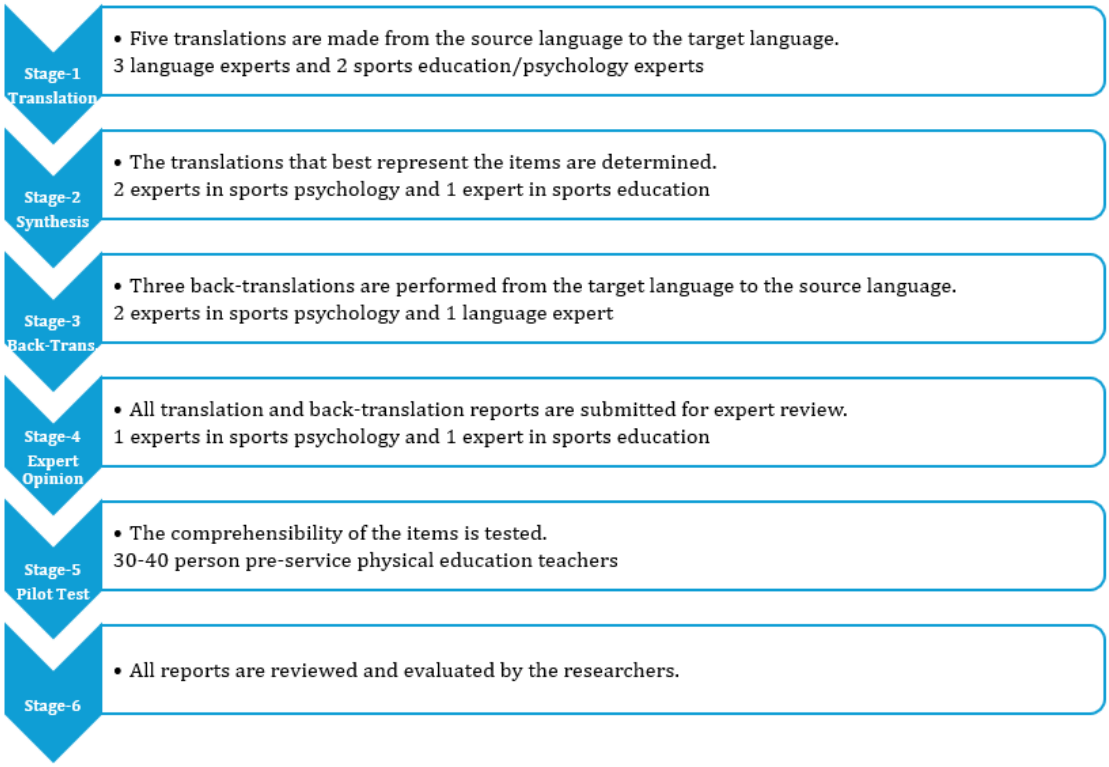

Figure 1. The suggested stages of cross-cultural adaptation studies (Beaton et al., 2000).

In the initial phase of the translation process, the English version of the scale was translated into Turkish by five specialists from academic English linguistics (3) and sports education/psychology (2) fields. Following this, the researchers developed a reviewer form to capture the similarities and differences among the translations. In the second phase, three specialists in sports education/psychology were consulted about the reviewer form. They compared the Turkish form items and identified common and suitable translations. Subsequently, the researchers created another reviewer form that documented the similarities and differences among the phrases identified by the specialists. In the third stage, specialists from academic English linguistics (1) and sports education/psychology (2) fields re-translated each of the translated items back to English. The fourth stage of the translation procedure was conducted by a sport psychology expert and a sport education specialist to ensure consistency within the physical education literature, who jointly examined the translated, back-translated, and original items. Then, in the fifth stage, 38 pre-service physical education teachers from four grade levels (1st grade = 7, 2nd grade = 8, 3rd grade = 12, and 4th grade = 11) completed the final version of the scale to test whether or not all items were clear and understood. In the sixth and final stage, the researchers meticulously reviewed all the collected feedback, leading to the finalization of the scale in its Turkish version.

2.4. Data Collection Procedure

Before initiating the data collection process, the necessary permissions were obtained from the authors who developed the teacher identity scale for pre-service physical education teachers. Following this approval, ethical clearance was obtained from the Ethics Committee of Sakarya University of Applied Sciences on 14 June 2024 (Ethics Approval Number: E-26428519-050.99-129839). Formal requests were submitted to the relevant institutions to initiate the data collection process in universities, and the necessary permissions were obtained. Data were collected during the 2023–2024 academic year from students of various grade levels and genders enrolled in physical education and sports teaching programs at universities in the Marmara Region. The data collection process was conducted during the final and make-up exam periods using both online platforms and face-to-face methods. Participants were informed about the study's purpose and procedures, ensuring their voluntary participation.

2.5. Data Analysis

Confirmatory Factor Analysis (CFA) and Exploratory Structural Equation Modeling (ESEM) were conducted to evaluate construct validity. CFA and ESEM involved a detailed examination of fit indices and item factor loadings. The fit indices included the ratio of chi-square to degrees of freedom (S-Bχ^2/df), the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). The fit of a model with an S-Bχ^2/df ratio of less than 3 indicates an acceptable level of fit (Schermelleh-Engel et al., 2003). RMSEA and SRMR values between 0 and 0.05 indicate a good fit, while values from 0.05 to 0.10 suggest an acceptable fit (Schermelleh-Engel et al., 2003). TLI and CFI values greater than 0.90 indicate an acceptable fit, while values ranging from 0.95 to 1.00 reflect an excellent fit (Bentler, 1990; Hu & Bentler, 1999). Additionally, factor loadings are crucial for evaluating model adequacy, with a minimum of 0.40 recommended for these loadings (Stevens, 2002). In this analysis, the R software (R Core Team, 2021) was employed for CFA and ESEM, using the lavaan (Rosseel, 2012) and the esem packages (Prokofieva et al., 2023).

The square root of the Average Variance Extracted (√AVE) values for the factors, along with inter-factor correlations and Heterotrait-Monotrait (HTMT) ratios of correlations, were calculated to evaluate discriminant validity. As noted by Fornell and Larcker (1981), discriminant validity is confirmed when a factor accounts for more variance in its items than in the items associated with other factors. Thus, the √AVE values for each factor should be greater than the inter-factor correlation values. Additionally, inter-factor correlations should be maintained at a level below 0.80 (Meyers et al., 2017), and HTMT ratios should remain under 0.90 (Henseler et al., 2015). The Average Variance Extracted (AVE) and Composite Reliability (CR) values were calculated to evaluate convergent validity. Convergent validity is deemed established if the condition CR ≥ AVE ≥ 0.50 is fulfilled (Hair et al., 2017). Cronbach's alpha coefficient and composite reliability (CR) were assessed for reliability. Coefficients of 0.70 or higher indicate good reliability (Nunnally & Bernstein, 1994; Hair et al., 2010).

The assumption of multivariate normality was assessed by examining the multivariate skewness and kurtosis coefficients, along with descriptive statistics before conducting the CFA and ESEM (Table 1).

Table 1.
Descriptive Statistics for the Pre-service Physical Education Teachers' Teacher Identity Scale (PPET-TI)

PPET-TI	n	x̄	sd	Skewness	Kurtosis
Self-Definitions	250	5.09	1.50	-0.68	-0.27
Teaching Goals	250	6.04	0.95	-2.04	6.72
Professional Responsibilities	250	4.39	1.54	-0.37	-0.62
Total Scale	250	5.33	0.92	-0.87	2.53

Table 1 indicates that the assumption of multivariate normality is not satisfied (Kline, 2011). In the CFA models, PPET-TI scores were explained by three correlated latent factors, with no cross-loadings or correlated uniqueness. In the ESEM solutions, all cross-loadings were estimated using the Diagonally Weighted Least Squares (DWLS) method.

3. FINDINGS

The results of the CFA indicated that S-Bχ^2/df 1.90, CFI 0.95, TLI 0.94, RMSEA 0.06, and SRMR 0.05. The results of the ESEM indicated that S-Bχ^2/df 2.79, CFI 0.98, TLI 0.97, RMSEA 0.08, and SRMR 0.03 (Table 2).

Table 2.
Fit Indices for CFA and ESEM of the PPET-TI

	x^2	df	CFI	TLI	RMSEA	SRMR
CFA	221.446	116	0.95	0.94	0.06	0.05
ESEM	254.619	91	0.98	0.97	0.08	0.03

The factor loadings (Table 3) the self-definitions subscale ranged from 0.58 to 0.97 (4 items); the teaching goals subscale ranged from 0.74 to 0.87 (8 items); the professional responsibilities subscale ranged from 0.76 to 0.88 (5 items) in the CFA. In contrast, the results of the ESEM indicated that the self-definitions subscale ranged from 0.55 to 0.80 (3 items); the teaching goals subscale ranged from 0.45 to 0.82 (10 items); the professional responsibilities subscale ranged from 0.61 to 0.69 (4 items).

Table 3.
Factor Loadings for the Items of the PPET-TI in CFA and ESEM

Subscale	Items	CFA / ESEM	Self-Definitions	Teaching Goals	Professional Responsibilities
Self-Definitions	1	**0.94**	**0.76**	0.53	0.27
	2	**0.97**	**0.80**	0.49	0.22
	3	**0.64**	**0.55**	0.43	0.17
	4	**0.58**	0.44	**0.45**	0.15
Teaching Goals	1	**0.85**	0.02	**0.82**	-0.32
	2	**0.87**	-0.08	**0.79**	-0.34
	3	**0.84**	-0.10	**0.80**	-0.32
	4	**0.84**	-0.05	**0.81**	-0.28
	5	**0.80**	-0.04	**0.78**	-0.29
	6	**0.85**	-0.06	**0.79**	-0.36
	7	**0.81**	-0.05	**0.80**	-0.25
	8	**0.74**	-0.08	**0.80**	-0.12
Professional Responsibilities	1	**0.83**	-0.14	0.55	**0.69**
	2	**0.85**	-0.22	0.60	**0.64**
	3	**0.82**	-0.30	0.55	**0.61**
	4	**0.88**	-0.29	0.52	**0.67**
	5	**0.76**	-0.19	**0.65**	0.48

The ESEM results, item 4 in the self-definitions factor and item 5 in the professional responsibilities factor, have higher factor loadings in the teaching goals factor. Item 4 indicated correlations ranged from 0.15 to 0.25 (p<.01, p<.05) with items in the teaching goals subscale and ranged from 0.36 to 0.90 (p<.01) with items in the self-definitions subscale. Similarly, item 5 indicated correlations ranged from 0.29 to 0.51 (p<.01) with items in the teaching goals subscale and ranged from 0.55 to 0.79 (p<.01) with items in the professional responsibilities subscale (Table 4).

Table 4.
The Relationship of Item 4 in the Self-Definitions Factor and Item 5 in the Professional Responsibilities Factor with Other Items

	TG 1	TG 2	TG 3	TG 4	TG 5	TG 6	TG 7	TG 8	SD 1	SD 2	SD 3	PR 1	PR 2	PR 3	PR 4
Self-Definitions Item 4	0.24**	0.15*	0.14*	0.21**	0.25**	0.19**	0.19**	0.15*	**0.54****	**0.55****	**0.33****	-	-	-	-
Professional Responsibilities Item 5	0.30**	0.30**	0.32**	0.33**	0.32**	0.29**	0.33**	0.51**	-	-	-	**0.55****	**0.63****	**0.61****	**0.72****

*p<.05 **p<.01 *TG:* Teaching Goals, *SD:* Self-Definitions, *PR:* Professional Responsibilities

The √AVE values of the factors, inter-factor correlations, and HTMT ratios were calculated to examine the discriminant validity of the scale. The results indicated that the √AVE values of the factors ranged from 0.80 to 0.82, the inter-factor correlation values ranged from 0.26 to 0.34, and the HTMT ratios of the correlations ranged from 0.30 to 0.37 (Table 5).

Table 5.
The √AVE Values, Correlations, and HTMT Ratios of the Subscales of the PPET-TI

	√AVE	r	1	2	3	HTMT	1	2	3
1 Self-Definitions	0.80		1				1		
2 Teaching Goals	0.82		0.30**	1			0.33	1	
3 Professional Responsibilities	0.82		0.26**	0.34**	1		0.30	0.37	1
Total Scale			0.66**	0.76**	0.75**				

**p<.01

AVE and CR values were analyzed to examine the convergent validity of the scale. CR and Cronbach's alpha values were evaluated to assess their reliability. The results indicated that the AVE values ranged from 0.64 to 0.68, CR values ranged from 0.87 to 0.94, and Cronbach's alpha values ranged from 0.85 to 0.94 (Table 6).

Table 6.
AVE, CR and Cronbach's α Values for the PPET-TI

	AVE	CR	Cronbach's α
Self-Definitions	0.64	0.87	0.85
Teaching Goals	0.68	0.94	0.94
Professional Responsibilities	0.68	0.91	0.91
Total Scale	0.67	0.97	0.90

4. RESULTS, DISCUSSION AND RECOMMENDATIONS

This study aimed to examine the reliability and validity of the PPET-TI, developed by Liu and Keating (2022) based on the DSMRI theoretical framework, in the Turkish sample. The factor structure of the scale was examined through CFA and ESEM. Additionally, discriminant and convergent validity, along with the scale's reliability, were examined.

The CFA results, the S-Bχ^2/df, RMSEA, and SRMR values provided acceptable fit indices suggested by Schermelleh-Engel et al. (2003), and the TLI value provided acceptable fit indices suggested by Hu and Bentler (1999). Furthermore, the CFI value provided excellent fit indices suggested by Hu and Bentler (1999). The ESEM results, the S-Bχ^2/df, and RMSEA values provided acceptable fit indices suggested by Schermelleh-Engel et al. (2003). Additionally, the SRMR value provided excellent fit indices suggested by Schermelleh-Engel et al. (2003), and the TLI and CFI values provided excellent fit indices suggested by Hu and Bentler (1999). Both CFA and ESEM results confirmed the intended latent structure, with fit indices falling within acceptable to excellent ranges (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). ESEM results revealed slightly superior SRMR, CFI, and TLI values as theoretically expected because its allowance for small cross-loadings provides a more realistic representation of multidimensional constructs (Asparouhov & Muthén, 2009; Marsh et al., 2014). Teacher identity represents one such construct, as it integrates self-definitions, teaching goals, and professional responsibilities. Marsh et al. (2013) argued that for ESEM to be preferred, it should demonstrate better-fit indices than CFA. Factor loadings, factor distributions, and inter-item correlations were also examined to determine which analysis provided better results.

A factor loading represents the value that explains the relationship between an item on a scale and its corresponding dimension. The obtained factor loadings were high, which indicated that items strongly represent the respective subscale (Büyüköztürk, 2002). In this study, the CFA results were consistent with the original factor structure of the scale (Liu and Keating, 2022), and the items loaded significantly on their respective factors. The factor loadings of all items indicated higher values in CFA. According to the ESEM results, the items in the teaching goals subscale were consistent with the original factor structure of the scale. However, Item 4 in the self-definitions subscale (I believe others think of me as a future physical teacher) and Item 5 in the professional responsibilities subscale (Attend Professional development learning opportunities related to physical education) indicated that higher factor loadings in the teaching goals factor. These items may appear to load more strongly on conceptually related but unintended factors in ESEM analyses, even though their primary theoretical alignment remains consistent in CFA. This suggests that the observed differences are not necessarily indicative of structural problems but rather reflect the sensitivity of ESEM to secondary associations between items and constructs (Asparouhov & Muthén, 2009). The mean score highlights the significance of the relationships among all items. However, when the relationships between these items and the subscales were examined, the relationships with the factor distribution revealed by CFA were found to be stronger than those with the factor distribution revealed by ESEM. According to item factor loadings, factor distributions, and inter-item correlations, the CFA results demonstrated greater consistency with the original structure (Liu & Keating, 2022) of the scale.

The fit indices, item factor loadings, factor distributions, and item correlations indicated that the CFA results were consistent with the original structure of the scale, consisting of 3 subscales and 17 items (Liu & Keating, 2022). On the other hand, the ESEM results indicated that discrepancies with the original structure of the scale. The findings showed that although ESEM, as a modern analytic technique, provides a more flexible approach, CFA produced results more consistent with the original factor structure of the PPET-TI. In the literature, ESEM is recommended because it allows for cross-loadings, which enables a more realistic modeling of relationships between factors, and it is considered a powerful technique, particularly for exploring complex structures (Asparouhov & Muthén, 2009; Marsh et al., 2014). Some studies, however, note that when a scale has strong theoretical foundations and the factor structure is clearly predefined, CFA can yield better-fit indices (Brown, 2015). In this context, the finding that CFA provided a better fit in adapting the theoretically defined structure of the PPET-TI to the Turkish culture may be explained by the conceptual clarity of the scale and the distinct separation among its factors. Thus, while ESEM contributed value by testing the flexibility of the factor structure, the higher fit values obtained from CFA indicated that the theoretical structure of the scale remained robust within the Turkish sample.

The $\sqrt{}$AVE values of the factors, the correlations between factors, and the HTMT ratios were at acceptable levels for discriminant validity. These values provided better results compared to the original structure of the scale (Liu & Keating, 2022). The AVE and CR values were at acceptable levels for convergent validity. These values were consistent with the original structure of the scale (Liu & Keating, 2022). The scale's reliability was assessed using Cronbach's alpha and composite reliability coefficients. Cronbach's alpha does not provide information on homogeneity or unidimensionality and tends to increase with the number of items in the scale; therefore, both methods were used in conjunction (Hair et al., 2010). The Cronbach's alpha and composite reliability coefficients for each subscale and the total scale were found to be at the level recommended by Hair et al. (2010), and the Turkish version of the scale is highly reliable. All reliability values were consistent with the original structure of the scale (Liu & Keating, 2022), with some values showing even better results.

As a result of all the analyses, the scale's construct, convergent, and discriminant validity, as well as its reliability, were supported. In other words, the Turkish version of the PPET-TI is a valid and reliable measure for determining the teacher identity of pre-service physical education teachers (Appendix). This scale holds potential not only for assessing teacher identity but also for guiding physical education and sport teacher education practices. Supporting pre-service teachers'

professional development and career choices, it can inform curriculum design, enable longitudinal investigations into the evolution of teacher identity, and provide a basis for evaluating the effectiveness of teacher education programs, ultimately contributing to their overall improvement.

There are some limitations in this study. Cronbach's alpha and composite reliability (CR) values were examined to assess the reliability of the scale. Since the measurement was conducted within a single time frame, both methods were applied simultaneously, which limits the ability to capture temporal stability. Future studies could test reliability across different time points using the test–retest method to provide stronger evidence for the scale's stability. The criterion validity of the scale was not determined, and discriminant and convergent validity were examined through √AVE values, inter-factor correlations, HTMT ratios, AVE, and CR values. As a result, the interpretations regarding construct distinctiveness should be made cautiously. In future research, scales with established validity and reliability could be used to provide additional evidence for criterion-related and convergent validity. The sample consisted of pre-service physical education and sports teachers studying at universities in the Marmara Region. Therefore, the generalizability of the results is limited to this specific geographical and institutional context. Future studies could include participants from all seven regions of Türkiye to create a stratified sample that represents the national population, thereby enhancing the external validity of the scale. Additionally, the measurement invariance of the scale across variables such as gender and grade level was not examined in this study, which restricts the ability to determine whether the construct operates equivalently across subgroups. Consequently, the generalization of findings should be approached with caution. Future research can strengthen the robustness and cross-group applicability of the scale by testing its measurement invariance across demographic and academic variables. Moreover, data were collected through self-report measures, which may have introduced potential biases such as social desirability and response tendencies. This limitation is particularly relevant in teacher education contexts, where participants might respond in ways that align with professional expectations rather than personal beliefs. Finally, the cross-sectional design of the study restricts the ability to capture changes in teacher identity over time, thus limiting inferences about developmental trajectories. Future studies could mitigate these limitations by incorporating longitudinal designs, triangulating self-report data with observational or peer-assessment methods, and applying procedural remedies to reduce common method variance.

Research and Publication Ethics Statement

The authors declare that all information in this study has been obtained and presented by academic rules and ethical conduct. Additionally, this study was approved by the Sakarya University of Applied Sciences Ethics Committee (14 June 2024, Ethics Approval Number: E-26428519-050.99-129839).

Contribution Rates of Authors to the Article

The authors declare that each author made an important contribution to every stage of the study. The three authors worked together during the analysis and reporting of the data.

Statement of Interest

The authors declare that they have no financial, personal, or institutional conflict of interest related to this study.

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APPENDIX

Beden Eğitimi Öğretmen Adayları Öğretmen Kimliği Ölçeği (BEÖA-ÖK)

Açıklama: Aşağıda beden eğitimi öğretmen adayları için öğretmen kimliği ölçeği yer almaktadır. Ölçek şu andaki düşüncelerinizi, gelecekteki beden eğitimi derslerinizdeki hedeflerinizi ve yakın gelecekteki planlarınızı ifade eden 3 alt boyuttan oluşmaktadır. 1'den (Tamamen Katılmıyorum/Hiç) 7'ye (Tamamen Katılıyorum/Çok Yüksek) doğru derecelendirilen ifadelerden size en uygun olanı işaretleyiniz.

Öz Tanımlamalar	**Şu anda,**	**Tamamen Katılmıyorum**	**Çoğunlukla Katılmıyorum**	**Biraz Katılmıyorum**	**Ne Katılıyorum Ne Katılmıyorum**	**Biraz Katılıyorum**	**Çoğunlukla Katılıyorum**	**Tamamen Katılıyorum**
	1-Sık sık beden eğitimi öğretmeni olduğumu hayal ediyorum.	1	2	3	4	5	6	7
	2-Kendimi geleceğin beden eğitimi öğretmeni olarak görüyorum.	1	2	3	4	5	6	7
	3-Kendimi gelecekte beden eğitimi öğretmeni olarak görmüyorum.	1	2	3	4	5	6	7
	4-Başkalarının beni geleceğin beden eğitimi öğretmeni olarak düşündüklerine inanıyorum.	1	2	3	4	5	6	7
Öğretim Hedefleri	**Gelecekteki beden eğitimi derslerinizde, aşağıdakilere önemli ölçüde zaman ayırma olasılığınız nedir?**	**Hiç**	**Çok Az**	**Az**	**Kısmen**	**Orta**	**Yüksek**	**Çok Yüksek**
	1-Öğrencilerin çeşitli fiziksel aktivitelerden keyif almalarına yardımcı olmaya	1	2	3	4	5	6	7
	2-Öğrencilerin çeşitli fiziksel aktivitelerdeki hareket yeterliliğine	1	2	3	4	5	6	7
	3-Öğrencilerin sağlıkla ilgili fiziksel uygunluğuna	1	2	3	4	5	6	7
	4-Fiziksel olarak aktif bir yaşam tarzının bilgi ve becerilerini öğretmeye	1	2	3	4	5	6	7
	5-Hareket ve fiziksel performansa yönelik bilgileri (kavramlar, ilkeler, stratejiler vb.) öğretmeye	1	2	3	4	5	6	7
	6-Öz disiplini, kuralları ve görgü kurallarını öğretmeye	1	2	3	4	5	6	7
	7-Öğrencilerin çeşitli hareket becerilerinde ustalaşmalarına yardımcı olmaya	1	2	3	4	5	6	7
	8-Fiziksel aktivitelere katılımın önemi hakkında farkındalık oluşturmaya	1	2	3	4	5	6	7
Mesleki Sorumluluklar	**Önümüzdeki birkaç ay içinde aşağıdakileri yapma olasılığınız nedir?**	**Hiç**	**Çok Az**	**Az**	**Kısmen**	**Orta**	**Yüksek**	**Çok Yüksek**
	1-Beden eğitimi ile ilgili mesleki kuruluşlara katkıda bulunma (ör. etkinlikler düzenlemek, bağış toplamak, bağış yapmak)	1	2	3	4	5	6	7
	2-Okul sağlığı ve fiziksel aktivite ile ilgili projelerde/girişimlere aktif olarak yer alma/dahil olma	1	2	3	4	5	6	7
	3-Anasınıfından 12. sınıfa kadar olan okullar için beden eğitimi müfredatı ve programı geliştirmeye yardım etme faaliyetlerinde bulunma	1	2	3	4	5	6	7
	4-Beden eğitimi ile ilgili mesleki organizasyonlarda aktif üyeliğe başlama veya sürdürme	1	2	3	4	5	6	7
	5-Beden eğitimi ile ilgili mesleki gelişim öğrenme fırsatlarına katılma	1	2	3	4	5	6	7