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## DESIGN OF AN INVENTORY FOR THE EVALUATION OF ATTITUDES AND TEACHING PRACTICES ON SUSTAINABLE DEVELOPMENT IN PHYSICAL EDUCATION

## OBLIKOVANJE INSTRUMENTA ZA OCENJEVANJE STALIŠČ IN UČNIH PRAKS O TRAJNOSTNEM RAZVOJU V ŠPORTNI VZGOJI

### ABSTRACT

This pilot study examines the content validity and reliability of an inventory designed to assess physical education teachers' attitudes, perceptions, and teaching practices related to sustainable development. The inventory was developed by adapting two validated instruments: the Attitudes and Perceptions on Education for Sustainable Development scale and the Assessment Tool for Physical Education for Sustainable Development. These instruments underwent content and face validity evaluation before piloting. The study aimed to assess the inventory's internal consistency using Cronbach's  $\alpha$  coefficients and its stability through a test-retest procedure. Thirty-two Greek physical education teachers (8 males, 24 females;  $M = 48.85$  years,  $SD = 6.18$ ) completed the inventory twice, with a 20-day interval. Reliability analysis indicated that Cronbach's  $\alpha$  coefficients for individual factors ranged from 0.70 to 0.87, demonstrating adequate internal consistency. Test-retest results confirmed satisfactory stability in most question categories. Findings suggest that the inventory is a valid and reliable tool for assessing sustainable development-related attitudes and practices in physical education, with minor refinements recommended for specific items before broader application. This study highlights the need for robust assessment tools to evaluate education for sustainable development, particularly in physical education, where fostering sustainability-oriented attitudes is essential for promoting corresponding teaching practices.

**Keywords:** Measurement reliability, physical education teachers, sustainable development, SDGs, questionnaire.

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### IZVLEČEK

Ta pilotska študija preučuje vsebinsko veljavnost in zanesljivost instrumenta, zasnovanega za ocenjevanje stališč, zaznav in učnih praks učiteljev športne vzgoje v povezavi s trajnostnim razvojem. Instrument je bil razvit z adaptacijo dveh validiranih pripomočkov: Lestvice stališč in zaznav o izobraževanju za trajnostni razvoj ter Ocenjevalnega orodja za športno vzgojo za trajnostni razvoj. Pred pilotno uporabo sta instrumenta prestala ocenjevanje vsebinske in površinske veljavnosti. Cilj študije je bil oceniti notranjo konsistentnost instrumenta s pomočjo Cronbachovega  $\alpha$  koeficienta in njegovo zanesljivost preko postopka test-retest. Dvaintrideset grških učiteljev športne vzgoje (8 moških, 24 žensk; povprečna starost = 48,85 let,  $SD = 6,18$ ) je instrument izpolnilo dvakrat, z 20-dnevnim presledkom. Analiza zanesljivosti je pokazala, da so Cronbachovi  $\alpha$  koeficienti za posamezne faktorje znašali od 0,70 do 0,87, kar kaže na ustrezno notranjo konsistentnost. Rezultati test-retest so potrdili zadovoljivo zanesljivost v večini kategorij vprašanj. Ugotovitve kažejo, da je instrument veljavno in zanesljivo orodje za ocenjevanje stališč in praks, povezanih s trajnostnim razvojem v športni vzgoji, pri čemer so pred širšo uporabo priporočene manjše prilagoditve nekaterih postavk. Študija poudarja potrebo po zanesljivih ocenjevalnih orodjih za spremljanje izobraževanja za trajnostni razvoj, zlasti v športni vzgoji, kjer je spodbujanje trajnostno naravnanih stališč ključno za ustrezne učne prakse.

**Ključne besede:** zanesljivost merjenja, učitelji športne vzgoje, trajnostni razvoj, cilji trajnostnega razvoja (CTR), vprašalnik

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## INTRODUCTION

Sustainable Development (SD) is a central issue globally, with the 17 Sustainable Development Goals (SDGs) of the United Nations aiming for balanced development in the social, environmental, and economic dimensions (UNESCO, 2017). According to the Brundtland Report by the World Commission on Environment and Development (1987), sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 43). Similarly, the Report of the World Summit on Sustainable Development (United Nations, 2002) reaffirmed this definition, emphasizing the importance of intergenerational responsibility in preserving natural resources and ensuring social balance for future generations.

According to Kickbusch and Hanefeld (2017), the priority for achieving the SDGs is to raise awareness of their importance and implementation among the general population. This is deemed necessary as contemporary social problems are multidimensional and require a holistic, coordinated approach and involves significant changes in the mindset and behavior of citizens (Swain & Yang-Wallentin, 2019). Education is a foundational factor for these changes as it helps to shape values, attitudes, and behaviors. Education interventions influence the way people think and act, promoting sustainable development, social cohesion, and active participation (Sterling, 2010).

More specifically, within education, Physical Education (PE) plays a crucial role in promoting SD, as it focuses not only on physical health, but also on the development of social, moral, and environmental values (Lynch, 2019). The value of PE and sports has been highlighted as a tool for social change since 1978. Through the International Charter for Physical Education (UNESCO, 2015), the study of PE is recognized in the 2030 Agenda as a key construct for achieving the SDGs. This fact is confirmed as strategies and methodologies of teaching PE, such as the individual and group responsibility model and cooperative learning, enhance the formation of positive behaviors. Through these approaches, children and young people develop sustainable skills and attitudes that contribute to responsible social and environmental action (García-Rico et al., 2021).

Themes such as promoting justice, equality, diversity, and inclusion can be integrated into PE to help students acquire sustainable behaviors and habits (Thorburn, Gray, & O'Connor, 2019). Although the contribution of the PE course to achieving the SDGs is significant, it is not sufficient to meet all the objectives. According to Baena-Morales, Merma-Molina and Gavilán

(2021), out of 169 individual UNESCO goals, only 24 can be promoted through PE, for example: (a) health and well-being (SDG 3), (b) quality education (SDG 4), (c) gender equality (SDG 5), (d) reducing inequalities (SDG 10), (e) responsible consumption and production (SDG 12), and (f) sustainable cities and communities (SDG 11).

Despite the importance of PE, the integration of SD in the classroom remains limited, which highlights the need to develop and use reliable assessment tools (Lozano et al., 2017). Assessing PE teachers' attitudes, perceptions, and teaching practices regarding SD is critical for enhancing sustainability education. Although there are several research tools that assess the relationship between education and sustainability, few of them focus exclusively on PE. It is important to underline that the terms "attitudes", "perceptions", and "beliefs", although similar, are distinct of one another and should not be used interchangeably.

Research on teachers' perceptions of SD education highlights both its recognized importance and implementation challenges. Educators generally hold positive attitudes toward integrating SD into the curriculum, yet studies indicate that many are not familiar with key concepts, such as the "Sustainable School" model, and tend to associate SD primarily with environmental concerns rather than its social, economic, and cultural dimensions (Sfakianakis & Papastefanaki, 2020). The need for further training and institutional support has been widely emphasized, as teachers often struggle to translate sustainability principles into classroom practice. However, assessing educators' attitudes remains a complex issue. Existing tools, such as the Environmental Attitudes Inventory (Milfont & Duckitt, 2010), offer detailed insights into environmental perspectives, yet their length limits the practical use and implementation in time-constrained educational settings. Similarly, other instruments, such as the questionnaire developed by Papadopoulou (2022), provide valuable data on teachers' perceptions of SD; however, focus broadly on education rather than the specific context of PE.

Further research highlights gaps in assessing PE teachers' perspectives and practices regarding SD. Recent studies have attempted to develop and validate measurement scales for SD beliefs among future PE teachers (Lohmann et al., 2024). However, these studies focus mainly on pre-service educators with no teaching experience. This limitation may affect the accuracy of their responses. Additionally, qualitative research has explored PE teachers' perceptions of SDGs and Education for Sustainable Development (ESD) (Baena-Morales et al., 2022). Findings suggest that teachers value sustainability but struggle to integrate it into their teaching practices. Limited resources, lack of training, and insufficient guidance are the major barriers. These

challenges highlight the need for more targeted assessment tools. Such tools should capture both teachers' theoretical understanding and their ability to apply SD in PE teaching.

Although the above questionnaires provide valuable information on teachers' attitudes and perceptions of SD, some limitations emerge. Specifically, most of the instruments do not focus exclusively on PE, which makes it difficult to draw specific conclusions about this sector. Furthermore, existing questionnaires focus mainly on the theoretical understanding of SD, while its practical application in PE has not been sufficiently explored. There is a clear need to develop more specific tools that combine the assessment of attitudes and teaching practices of PE teachers. The availability of valid and reliable questionnaires is critical to understanding PE teachers' attitudes, perceptions, and teaching practices regarding SD. Therefore, this study attempts to fill this research gap by focusing on analyzing the reliability of two questionnaires designed to measure PE teachers' attitudes, perceptions, and teaching practices towards SD.

The purpose of the present study is to evaluate the reliability and validity of two questionnaires designed to capture the attitudes, perceptions, and teaching practices of PE teachers towards SD. Specifically, the study seeks to examine: (a) the content and face validity of the questionnaires to ensure they accurately reflect the construct under investigation, (b) the internal consistency of the questionnaires through Cronbach's alpha and McDonald's omega indices and (c) the test-retest reliability of the questionnaires through the intraclass correlation coefficient (ICC). This is a preliminary study that aims to provide initial insights into the reliability of these assessment tools. The results of the present study are expected to contribute to the development of more reliable assessment tools, enhancing the possibility of integrating SD into PE and educational practices in general.

## **METHODS**

### **Participants and Ethics**

Thirty-two primary school PE teachers (75% women, 25% men) were asked to participate in the study on a voluntary basis. The selection of participants was based on the premise that they were active teachers with at least five years of teaching experience and without any age restriction. Of the total number of teachers, 27 participated in the first distribution of the questionnaires, while 22 participated in both distributions. Therefore, of the remaining 10 participants, five completed the questionnaires only in the first measurement and five completed

only the second measurement. The descriptive statistics presented focus on the 27 participants in the first measurement, who had a mean age of 48.85 years ( $SD = 6.18$ ). Of these, 19 (70%) were females and eight (30%) were males. Regarding the level of education, 14 participants (51.9%) had a master's degree, while five participants (18.5%) had a second degree. Finally, 19 participants (70%) worked as permanent teachers, while the remaining eight (30%) were substitute teachers. All participants were informed in detail about the purpose and procedure of the survey, as well as their right to withdraw at any time, without having to give reasons for their decision. Anonymity and protection of personal data was ensured, as the researcher was responsible for recording them in her personal file. The research was approved by the Ethics and Bioethics Committee of the National and Kapodistrian University of Athens, School of Physical Education and Sports Science.

### **Instruments**

In order to develop the instruments used, an extensive literature review was conducted to identify quantitative tools that assess the attitudes, perceptions, and teaching practices of PE teachers in relation to the promotion of SD. Two questionnaires were identified and selected for the development of the questionnaires following expert consensus.

The first developed questionnaire aimed to assess the attitudes and perceptions of PE teachers on SD. Initially, a content and face validity assessment was conducted to ensure that the questionnaire accurately captured the intended constructs in terms of clarity, relevance, and adequacy. For its development, questions were selected from the questionnaire of Kougias, Sardianou and Saiti (2023), which included 14 sections with 116 questions in total. This questionnaire was used with Greek secondary school PE teachers. A content validity check of the questionnaire was conducted in terms of relevance, wording and adequacy of questions and a final selection and refinement of questions was conducted, resulting in 44 questions divided into 4 sections and 7 factors.

The second questionnaire aimed to evaluate the teaching practices of PE teachers that promote the Development of Sustainable Attitudes among their students. For its development, questions were selected from Baena-Morales et al. (2024) questionnaire which consisted of 25 questions, and it is divided into two factors (15 questions in Factor 1 and 10 questions in Factor 2). This questionnaire has been validated with Hispanic primary and secondary education teachers (19.35% from Spain, 32.45% from Peru, 34.9% from Ecuador, 12.7% from El Salvador and 0.6% from Mexico). In the present survey, the questionnaire was translated by five English

language experts and adapted to the Greek population. Subsequently, a content validity check was performed in terms of relevance, wording, and adequacy of questions, resulting in 20 questions (11 questions in factor 1 and nine questions in factor 2).

### **Procedures**

The two questionnaires used in the present study included 64 five-point Likert scale questions, with possible answers ranging from (1) Strongly disagree to (5) Strongly agree, and 13 questions on demographic characteristics (e.g., gender, age, school district, professional relationship (substitute, permanent), professional experience in primary education, etc.). Finally, four questions related to sustainability were included. Data collection was conducted through Google Forms, where clear instructions for completion were provided, and anonymity and confidentiality of responses were fully ensured.

### **Data analysis**

Cronbach's alpha coefficient and McDonald's omega index were calculated to assess the internal consistency of the questionnaires. In cases where the value of Cronbach's  $\alpha$  was not acceptable ( $\alpha < 0.70$ ), a sequential question removal procedure was followed to maximize the coefficient with a cut-off threshold of 0.70. Specifically, to improve internal consistency, items that negatively affected Cronbach's alpha were removed one by one, based on item-total correlations and reliability values. After each removal, the scale's reliability was recalculated. The final items were reviewed by two experts to ensure content clarity and relevance. Results were interpreted according to the criteria of George and Mallery (2003). To assess the stability of the responses (test-retest reliability), the questionnaire completion procedure was repeated after 20 days, allowing comparison of responses from the two measurements. Twenty-two PE teachers participated in this analysis. The responses were tested for their absolute agreement and the intraclass correlation coefficient (ICC) was used as a measure. The ICC value was interpreted according to the criteria of Koo and Li (2016). All statistical analyses were conducted with IBM SPSS version 29.0 (IBM SPSS Corp., Armonk, NY, USA).

## **RESULTS**

The internal consistency analysis was performed on the 27 PE teachers who completed the questionnaires at the first measurement, and the test-retest analysis on the 22 PE teachers who participated in both measurements. The results of an internal consistency analysis of the first

questionnaire assessing the attitudes and perceptions of PE teachers on SD, showed the following: The first section of the questionnaire measures teachers' misconceptions about sustainability and initially consisted of 5 questions. As the value of Cronbach's coefficient  $\alpha$  was not acceptable ( $\alpha = 0.41$ ), a sequential question removal procedure was followed to maximize the coefficient, using a cut-off threshold of .70. The final version of the factor contained 3 questions with a coefficient  $\alpha = 0.82$  ( $\omega = 0.82$ ).

The second section of the questionnaire measured the barriers for implementing SD in teaching PE and originally consisted of four factors and 25 questions. Reliability analysis was conducted at the factor level and is described in detail below. Factor 1 measures barriers to SD education and originally consisted of 9 questions. As Cronbach's  $\alpha$  coefficient value was not acceptable ( $\alpha = 0.53$ ), a sequential question removal procedure was followed to maximize the coefficient, using a cutoff threshold of 0.70. The final version of the factor contained four questions with a coefficient  $\alpha = 0.70$  ( $\omega = 0.70$ ), indicating a satisfactory level of reliability. The second factor measured economic resource barriers and initially consisted of eight questions with a satisfactory level of reliability ( $\alpha = 0.77$ ). The third factor measured teachers' perceptual barriers and originally consisted of four questions. However, as the coefficient value was not at a satisfactory level ( $\alpha = 0.24$ ), and the sequential question removal procedure failed to raise the coefficient value above the 0.70 threshold, this factor was entirely removed. Finally, as the fourth factor measuring social barriers did not have satisfactory internal consistency (4 questions,  $\alpha = 0.41$ ) and the sequential question removal procedure failed to raise the coefficient value above the threshold of 0.70, it was decided to combine the third and fourth factors into a common factor measuring socioeconomic barriers. The new factor, Socio-economic barriers, includes 12 questions with a Cronbach's  $\alpha = 0.79$  ( $\omega = 0.77$ ), demonstrating a satisfactory level of internal consistency.

The third section of the questionnaire measured the incentives of PE teachers to guide them during the integration of sustainability in their teaching practices. It consisted of eight questions and the Cronbach's coefficient  $\alpha$  was found equal to  $\alpha = 0.70$  ( $\omega = 0.59$ ), indicating a satisfactory level of reliability. Finally, the fourth section of the questionnaire measured the effectiveness of training in terms of sustainability. It consisted of six questions and Cronbach's  $\alpha$  coefficient obtained was  $\alpha = 0.87$  ( $\omega = 0.87$ ), indicating a high level of reliability. A detailed breakdown of the factors as well as the remaining questions are presented in Table 1.

Table 1. Cronbach's  $\alpha$  and McDonald's  $\omega$  reliability coefficients, of the attitudes and perceptions of PE teachers on sustainable development questionnaire.

Factors	Number of questions	Cronbach's $\alpha$	McDonald's $\omega$
Misconceptions	3	0.82	0.82
Barriers in Education	4	0.70	0.70
Socio-economic barriers	12	0.79	0.77
Incentives	8	0.70	0.59
Efficiency	6	0.87	0.87
Total Questions (5 Factors)	33		

The results of the test-retest analysis of the first questionnaire assessing PE teachers' attitudes and perceptions about SD showed the following: in the first section of the questionnaire on misconceptions about SD, the results of the test-retest reliability analysis yielded an  $ICC = 0.488$  ( $p = 0.63$ ). This value is marginally not statistically significant, which could possibly be attributed to the low power of the test due to the small sample size.

For the second section on barriers (barriers to education, socio-economic barriers), the test was carried out at the level of the overall scale and at the level of factors (two factors). The results showed that the overall scale is stable over time ( $ICC = 0.742$ ,  $p = 0.001$ ), and a similar result is confirmed for the two factors, barriers to education ( $ICC = 0.801$ ,  $p < 0.001$ ) and socioeconomic barriers ( $ICC = 0.726$ ,  $p = 0.002$ ). The results of the third section focusing on incentives indicated a satisfactory temporal stability ( $ICC = 0.639$ ,  $p = 0.005$ ) as well as for the fourth section focusing on effectiveness ( $ICC = 0.563$ ,  $p = 0.035$ ).

The second questionnaire, which addressed the teaching practices of PE teachers that promote the development of sustainable attitudes among their students, consisted of 20 questions and two factors with subscales. The first factor was related to environmental, economic, and health sustainability, while the second factor was related to social and racial sustainability. In both factors, as well as in all subscales, Cronbach's  $\alpha$  coefficient values were found to be above the 0.70 threshold, so no question removal was performed to further increase the coefficients. The Cronbach's  $\alpha$  coefficient analysis obtained on the total of 20 questions (two factors) related to PE teachers' practices to develop sustainable attitudes was  $\alpha = 0.90$  ( $\omega = 0.82$ ), indicating a high level of reliability. The results of the analysis are presented in Table 2.

Table 2. Cronbach's  $\alpha$  and McDonald's  $\omega$  reliability coefficients of the teaching practices of PE teachers that promote the development of sustainable attitudes among their students questionnaire.

Factors	Number of questions	Cronbach's $\alpha$	McDonald's $\omega$
Environment, Economy, Health	11	0.89	0.87
Environment	4	0.88	0.90
Economy	3	0.70	0.89
Health	4	0.82	0.82
Social, Gender	9	0.91	0.92
Social	4	0.77	0.78
Gender	5	0.90	0.90
Total Questions (2 Factors)	20	0.90	0.82

The test-retest analyses of the second questionnaire, concerning the teaching practices of PE teachers that promote the Development of Sustainable Attitudes among their students, indicated that the *ICC* index values were satisfactory in all cases (see Table 3).

Table 3. Test-retest reliability coefficients of the teaching practices of PE teachers that promote the development of sustainable attitudes among their students questionnaire.

Factors	ICC	95% Confidence Interval	P-value
Environment, Economy, Health	0.720	0.321 - 0.884	0.003
Environment	0.685	0.286 - 0.869	0.006
Economy	0.466	- 0.330 - 0.781	0.086
Health	0.697	0.256 - 0.875	0.005
Social, Gender	0.732	0.359 - 0.888	0.002
Social	0.764	0.436 - 0.902	< 0.001
Gender	0.669	0.203 - 0.863	0.008
Overall scale (2 Factors)	0.610	0.036 - 0.840	0.021

## DISCUSSION

This preliminary study examined the content and face validity, as well as the reliability of two questionnaires designed to measure the attitudes, perceptions, and teaching practices of PE teachers regarding SD. The results indicated that, despite some modifications deemed necessary, most subscales of the questionnaires showed satisfactory levels of reliability, which supports the usefulness of the questionnaires in future research and educational practice. The study confirmed the findings of previous research on the difficulties of incorporating SD into PE. According to Kougias et al. (2023), PE teachers cite the lack of appropriate instructional materials, limited instructional time, and reduced autonomy in lesson planning as key barriers.

Similarly, Baena-Morales et al. (2024) report that PE teachers are often aware of the importance of sustainability but find it difficult to incorporate relevant practices into teaching due to lack of resources and appropriate training.

The results of the first questionnaire assessing the attitudes and perceptions of PE teachers about SD indicated high internal consistency in most subscales. However, the factor of teachers' views of sustainability showed low reliability and was removed, as the sequential question removal procedure failed to improve the coefficient value above the acceptable threshold. This finding suggests that PE teachers' perceptions of sustainability are more difficult to capture through standardized questionnaires, possibly because they are influenced by multiple social and cultural factors. According to Tilbury and Wortman (2004), sustainability perceptions are shaped by complex interactions between personal experiences, societal norms, and cultural influences, making them inherently variable and context dependent. This variability may explain the observed difficulty in reliably measuring teachers' views on sustainability through a standardized tool.

The pooling of factors related to economic and social barriers resulted in a new, more stable factor of socioeconomic barriers, reflecting the close correlation between economic and social challenges faced by PE teachers. This aligns with broader findings that economic and social dimensions of sustainability are often interrelated, as financial constraints can directly influence social opportunities and equity in education (Tilbury & Wortman, 2004).

The test-retest analysis showed that most scales maintained their stability at different time points. However, the misconceptions section showed a relatively low ICC value, which could be possibly attributed to the small sample size or the difficulty of participants maintaining stable views in this domain. In contrast, subscales related to barriers to education and socioeconomic barriers showed satisfactory temporal stability, suggesting that PE teachers are more confident about the barriers they face than their theoretical perceptions of sustainability. It is important to note that there are no reports on the reliability and validity checks of the questionnaire used in the Kougias et al. (2023) study; as a result, it is not possible to directly compare the findings between the present study and Kougias et al. (2023).

The internal consistency of the teaching practices of the second questionnaire on sustainable development was recorded at high levels in both this study and that of Baena-Morales et al. (2024), confirming the reliability of the instruments. In both cases, the sub-factors related to social and gender sustainability showed particularly strong consistency, indicating that PE

teachers maintain stable views and practices in these areas. Nevertheless, for interventions related to the environmental and economic dimensions of sustainability, Baena-Morales et al. (2024) reported slightly higher consistency, possibly due to differences in participants' educational backgrounds or teaching priorities in the countries studied. In the present study, reliability was also satisfactory, with smaller variations between factors, probably due to the homogeneity of the sample. In terms of the results' stability over time, both studies recorded satisfactory levels of repeatability in teachers' responses. The findings suggest that PE teachers' teaching practices related to sustainable development remain consistent across different time points, confirming that the instruments can be reliably used for longitudinal evaluations. Although there were small differences in values between the two studies, the overall picture confirms the stability of the questionnaires and their value for capturing sustainability-related teaching practices.

### **Strengths, limitations and future directions**

One of the main advantages of the study is the use of two different questionnaires, tailored to the needs of PE teachers, and the application of multiple methods of reliability assessment. In addition, the selection and testing of the questions in terms of content and relevance was carried out after obtaining the agreement of experts highly qualified and experienced in the field of Education for SD and PE. This fact reinforces the content and face validity of the tools and ensures their suitability for this research approach.

However, the study has some limitations. The small sample size limits the generalizability of the results, as well as the unequal gender representation (75% women, 25% men), which may not reflect the actual gender distribution in the field of PE teaching and could potentially bias the results. Furthermore, the geographical scope of the study was limited to Greek primary school PE teachers, which may affect the generalizability of the findings to other educational systems or cultural contexts.

To further enhance the assessment of teaching practices, future research could integrate complementary methods, such as classroom observations or the analysis of lesson plans, to verify whether the reported practices are effectively implemented. This would assist the cross-validation of self-reported data and reduction potential biases. Additionally, the self-report nature of the current study may have introduced social desirability bias, where participants respond in ways they believe are expected or acceptable. Although anonymity was ensured, the influence of this bias cannot be entirely ruled out. These limitations highlight the importance

of using mixed methods in future studies to obtain a more comprehensive understanding of PE teachers' engagement with sustainable development.

Moreover, although this pilot study focused primarily on assessing preliminary aspects of validity (i.e., content and face validity) and reliability, no exploratory or confirmatory factor analysis was conducted. This was due to the limited sample size and the preliminary nature of the study. Future research with a larger sample will include factor analysis to examine the underlying structure and improve the construct validity of the instruments. Finally, the study did not explore the potential impact of external factors on teachers' attitudes and practices, because this would go beyond the specified aims. Variables such as school policies, curriculum guidelines, availability of resources, and administrative support may significantly influence the integration of sustainable development in PE. Future studies should consider examining these contextual elements to better understand the broader environment in which PE teachers operate.

The findings offer practical implications for both teacher training programs and curriculum development. By using reliable tools to assess PE teachers' engagement with sustainable development, educators and institutions can identify areas where further training is needed and tailor professional development programs accordingly. These tools can also serve as evaluation instruments to measure the impact of sustainability-oriented interventions over time. Additionally, the integration of such inventories into school self-assessment processes could support a broader cultural shift toward sustainability in education. Ultimately, this research contributes to bridging the gap between theoretical understanding and pedagogical application of sustainability in physical education.

The availability of a reliable measurement tool specifically designed for PE teachers allows researchers and policymakers to better assess the current status of sustainability education in PE. This tool can be used to identify professional development needs, evaluate the effectiveness of training programs, and monitor changes in attitudes and practices over time. Additionally, the inventory can support schools and education authorities in aligning their teaching practices with the goals of the 2030 Agenda for Sustainable Development. In this way, the tool serves not only as a research instrument but also as a means to inform policy and guide educational practices aimed at integrating sustainable development more effectively into PE curricula.

## CONCLUSIONS

In summary, the results of the study demonstrate that the questionnaires developed to assess attitudes, perceptions, and teaching practices of PE teachers towards SD can be considered reliable. The internal consistency of the instruments was generally satisfactory, while test-retest reliability supported the stability of the responses over time. This research contributes to improving our understanding of the relationship between PE education and SD by providing reliable measurement instruments. However, further studies are needed to confirm the validity of the questionnaires and their application in different educational settings. Their use may support the development of educational programs and policies that enhance the teaching of SD through the teaching of PE.

Given the international priority UNESCO has given to the implementation of ESD, the research community and education stakeholders should work together to develop systematic training and program resources for PE teachers. Therefore, sustainability could be effectively integrated into education and will be able to promote the principles of the 2030 Agenda for SD. To achieve this, physical education must adopt a holistic approach that extends beyond motor skills development, incorporating sustainability principles, environmental awareness, and social responsibility. This transformation towards Holistic Physical Education and Health will enable students to cultivate sustainable behaviors and actively contribute to achieving the SDGs through their engagement in physical education.

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