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# PSYCHOMETRIC VALIDATION AND ADAPTATION OF THE ATTITUDE TOWARDS SUSTAINABLE DEVELOPMENT SCALE FOR PRE-SERVICE TEACHERS

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## Abstract

Education for Sustainable Development (ESD) plays a key role in achieving United Nations Sustainable Development Goal 4, which focuses on quality education and the development of sustainability skills. Understanding how future teachers view sustainable development is important because their attitudes influence how sustainability is taught in schools. This study adapted and validated the Attitudes Toward Sustainable Development (ASD) Scale for use in India, focusing on differences among Pre-service Teachers. The sample comprised 415 Bachelor of Education (B.Ed.) trainees selected through stratified random sampling from 6 B.Ed colleges of Punjab, India. The ASD Scale, originally developed by Biasutti and Frate (2017), was used to measure four domains: environment, economy, society, and education, using a 5-point Likert scale. To assess validity and reliability, the study used the Kaiser–Meyer–Olkin (KMO) test, Bartlett's Test of Sphericity, exploratory factor analysis (EFA) with principal factor analysis and varimax rotation, confirmatory factor analysis (CFA), and reliability analysis. EFA yielded a revised 16-item scale, and CFA indicated good model fit (CFI, RMSEA, RMR, GFI). The scale demonstrated strong internal consistency (Cronbach's alpha = 0.785). Results indicate that most Pre-service Teachers hold positive attitudes towards sustainable development. Notable gender differences were observed, with females showing more positive attitudes, but no major differences in other areas. The adapted ASD scale is valid and reliable for measuring sustainability attitudes among Pre-service Teachers in India. Data analysis was conducted using IBM SPSS (Version 26) and AMOS (Version 23).

**Keywords:** Confirmatory Factor Analysis, Exploratory Factor Analysis, Attitude, Sustainable Development, Pre-service Teachers.

## 1. INTRODUCTION

Sustainable Development has become a major global issue due to growing environmental, economic, and social challenges that require collective action. The United Nations' Sustainable Development Goals (SDGs), set in 2015, offer a framework to address these issues by 2030. The SDGs focus on key areas such as poverty, inequality, environmental degradation, and climate change (United Nations General Assembly 2015). SDG 4 is especially important for education, as it calls for inclusive, fair, and high-quality education and lifelong learning for everyone. Education is seen as central to spreading ideas of sustainable development, leading to greater focus on Education for Sustainable Development (ESD) (Cotton et al. 2007; Michalos et al. 2012; Olsson, Gericke, and Chang Rundgren 2015; Tilbury 2012). ESD includes programs and experiences that help people gain the knowledge, skills, and values needed for a sustainable future. It aims to give learners of all ages the tools to support sustainable development (UNESCO 2017). ESD encourages informed choices and responsible actions to protect the environment, support economic stability, and build a fair society for current and future generations. It highlights skills like critical thinking, problem-solving, and teamwork, which are important for tackling complex sustainability issues (Tilbury 2016). Higher education institutions are key in preparing future teachers with these ESD skills. Tejedor et al. (2022) note that ESD's broad approach, covering thinking, feeling, and practical skills, is essential for training teachers who can lead change in environmental, economic, and social areas. Making sustainability a core part of education helps people contribute to sustainable development and reach the SDGs (Kioupi and Voulvoulis, 2019).

Teachers significantly influence students' understanding of and attitudes toward sustainability. Due to their pivotal role, educators are well-positioned to foster sustainable behaviour and values among students. Pre-service teachers currently undergoing training are particularly important, as they will be responsible for imparting these concepts to future generations

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(Evans et al. 2017). Therefore, teacher education programs must ensure that future educators acquire the requisite knowledge, skills, and attitudes and behaviour to effectively integrate sustainable development into their teaching practices.

Studies show that teachers are better at helping students learn about sustainability when they both understand and care about the topic (Mogren and Gericke 2019). When teachers have positive attitudes toward sustainability, students are more curious to act in environmentally responsible ways (Pauw et al. 2015). However, many teacher education programs lack clear plans for integrating sustainability into their courses. Even when sustainability is taught, these programs often do not check if future teachers are truly ready to teach these topics (Ferreira et al. 2009).

Redman et al. (2021) emphasise the need for robust instruments to assess sustainability competencies, given their centrality to sustainable development. Their review identifies five core competencies: systems thinking, futures thinking, values thinking, strategic thinking, and interpersonal skills. The authors recommend using assessment tools specifically aligned with these competencies to enable educators to identify and address gaps in sustainability knowledge and practice. This recommendation aligns with the objective of the present study, which is to evaluate whether the Attitude Questionnaire for pre-service teachers effectively validates attitudes required for Education for Sustainable Development (ESD). Sustainable development is an increasingly prominent focus in education worldwide, aiming to cultivate knowledge, attitudes, and behaviour that support environmental preservation, social equity, and economic viability for future generations (UNESCO, 2017). Teacher education programs play a significant role in shaping educators who will promote sustainable values and practices, as educators' attitudes toward sustainable development significantly impact how they engage students on this critical topic (Biasutti & Frate, 2017). Pre-service Teachers' attitudes toward sustainable development may vary due to socio-demographic factors, including age, gender, place of residence, and academic discipline. Despite this emphasis, few dependable instruments are available in the Indian context to measure sustainability-related knowledge among pre-service teachers. Most global tools, such as those by Michalos et al. (2014), were developed in Western contexts and require cultural and linguistic adaptation to ensure validity. Punjab, a region facing acute environmental concerns—air pollution from crop-residue burning, groundwater depletion, and biodiversity loss—offers a critical context for studying sustainability awareness among Pre-Service Teachers. Punjab faces urgent sustainability challenges, especially air pollution from stubble burning and vehicle emissions, which impact cities like Amritsar and Ludhiana. Excessive groundwater extraction for paddy farming has led to a significant decline in the water table, threatening the long-term sustainability of farming. (Romana et al., 2026, pp. 13304-13319). These environmental problems are directly connected to SDG 6 (Clean Water), SDG 13 (Climate Action), and SDG 15 (Life on Land). For pre-service teachers, particularly those in B.Ed. programs, awareness of these issues is essential to promoting Education for Sustainable Development under SDG 4 (Quality Education). Validating a context-sensitive Attitude scale is essential to ensure that teacher educators are equipped to measure and foster sustainability literacy among future teachers. Incorporating local environmental concerns into educational research enhances the construct validity of such tools and aligns the teacher education curriculum with national imperatives and global Sustainable Development frameworks. Pre-service teachers often lack contextual knowledge of these SDG-related concerns despite policy efforts. (Nousheen et al., 2022, pp. 321-333) Validating a knowledge tool in this local context ensures it captures relevant environmental realities, thereby strengthening education for Sustainable Development. The study aims to provide a robust framework for assessing pre-service teachers' knowledge of sustainable development by presenting empirical data on the validity and reliability of the modified instrument. Biasutti and Frate (2017) developed a knowledge measurement questionnaire that has been widely used and validated in multiple international studies across diverse populations, including university students, secondary school students, and pre-service teachers. Its proven psychometric properties ensure that it effectively measures knowledge of education for Sustainable Development.

## 2. Literature Review

Quantitative studies on attitudes and behaviour in Education for Sustainable Development, especially those linked to SDG 4 (quality education), are becoming more common. However, researchers face several challenges when developing assessment tools in this area (Michalos et al. 2011; Michalos et al. 2012; Michalos et al. 2014; Olsson, Gericke, and Chang Rundgren 2015; Powell et al. 2011; Schneller, Johnson, and Bogner 2015). One of the major challenges is defining

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environmental attitudes, as different theoretical frameworks have yielded unclear and inconsistent definitions of sustainable development (SD). Psychosocial factors also play an important role in this area. There is no standard tool for measuring environmental and SD attitudes, partly because of the range of theoretical approaches (Schneller, Johnson, and Bogner 2015). Commonly used scales include the tools that assess environmental attitudes (Milfont and Duckitt 2010) and students' attitudes, awareness, and intention to act (Bergman 2015). Most of these instruments are designed for elementary or secondary school students (Dijkstra and Goedhart 2012; Karpudewan, Roth, and Chandrakesan 2015; Olsson, Gericke, and Chang Rundgren 2015; Powell et al. 2011). There is less research focused on college students' environmental attitudes and knowledge (Biasutti 2015; Shephard et al. 2011). Some scales for assessing attitudes about sustainable development measure students' skills, attitudes, and behaviours using UNESCO documents as a basis (Biasutti and Surian 2012; Michalos et al. 2012; Olsson, Gericke, and Chang Rundgren 2015). For example, Biasutti and Surian (2012) surveyed 467 bachelor's students from five fields—social sciences, educational sciences, applied sciences, engineering, and health sciences—to compare their beliefs and attitudes about ESD. Their questionnaire covered attitudes toward ESD and competences in five main learning areas: learning to be, learning to live together sustainably, learning to know, learning to do, and learning to transform oneself and society. The results showed clear differences between fields. Engineering students had the strongest pro-sustainability attitudes, ahead of students in applied sciences, health sciences, and social sciences. Social sciences students had a stronger pro-social profile, while health sciences students were the least socially oriented. Educational sciences students valued the social aspect of sustainability more than the knowledge and practical aspects, especially compared to engineering and applied sciences students, who scored higher on the learning-to-know and learning-to-do aspects. Attitudes towards sustainable development (ATSD)include views on environmental protection, social equity, and responsible economic development. These attitudes are seen as important psychological correlates of sustainability-oriented action ( Brundtland, 1987; Emas, 2015). However, research on sustainability often finds an attitude-behaviour gap, where people who say they support sustainability do not always act in ways that match those beliefs (Abubakar et al., 2016; Balakrishnan et al., 2020).

Some assessment tools use the UNESCO (2005) definition of sustainable development, which includes environmental, economic, and social dimensions. Michalos et al. (2014) created a tool to assess tenth-grade students' knowledge, attitudes, and behaviours about SD. This tool has 50 items grouped into three areas: SD knowledge, positive attitudes toward SD, and positive behaviours toward SD. Olsson, Gericke, and Chang Rundgren (2015) developed a Likert-scale questionnaire to measure students' sustainability awareness in grades six to nine, focusing on knowledge, attitudes, and behaviours in environmental, economic, and social areas. Both tools are meant for school-aged students, not university students. The Olsson, Gericke, and Chang Rundgren (2015) tool is based on the environment, economy, and social dimensions, which are called the pillars of Sustainable development as per UNESCO (2005). The environmental part covers resource awareness and the vulnerability of the physical environment. The economic section examines limits, growth potential, and environmental and societal impacts. The social part is seen as a democratic system in which people can participate in policy-making, share opinions, and elect leaders. These three areas are connected, and this model is widely used in Sustainable Development research studies (Gough 2002; Giddings, Hopwood, and O'Brien 2002; Olsson, Gericke, and Chang Rundgren 2015; Walshe 2008). However, many studies overlook education as a key part of these SD pillars. Education is central to Education for Sustainable Development (ESD), which is a main goal of UNESCO and Agenda 21 (UNESCO 1992). Agenda 21, especially Chapter 36 (UNESCO 1992; Section 36.3), highlights education as essential for supporting sustainable development and helping people face related challenges. Education should be valued alongside other SD parts and is important for building environmental and ethical awareness, as well as values and attitudes that support sustainable development. The goal is to help people take part in decision-making and policy. (Education for Sustainable Development, n.d.) To improve knowledge and attitudes about sustainability, constructivist and learner-centered teaching methods are recommended (Biasutti 2015; Corney and Reid 2007; McNaughton 2012; Scoullos 2013). These methods should use new teaching ideas, focus on future and higher-level thinking, encourage interdisciplinarity, and connect local and global issues. Scoullos (2013, 110) listed the following features of ESD learning methods: locally relevant; encouraging collaboration among schools, local actors and authorities, scientific communities, the private sector, and NGOs. They also reveal global issues and connections in everyday life, whether in a small village or a large city. These teaching and learning methods promote changes in behaviour and ways of thinking and relate not only to knowledge but also to processes, as they teach

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learners how to think, not what to think (Biasutti 2015). (Biasutti, 2015, pp. 734-752) The reviewed literature shows that several methods have been used to assess environmental attitudes. Many studies have contributed to this literature, but it is important to consider how these scales differ theoretically and conceptually from SD: a scale that measures environmental attitudes does not necessarily measure attitudes toward the environmental dimension of sustainability. (Kopnina & Cocis, 2017) For SD questionnaires, only a few tools have been developed, mainly focusing on primary and secondary school students' knowledge, attitudes, and behaviours (Michalos et al., 2012; Olsson, Gericke, and Chang Rundgren, 2015). These Sustainable development tools were based on the three dimensions—environment, economy, and society—but they do not focus on education, which is a crucial part of Education for Sustainable Development. The current research aims to address these gaps by validating and adapting a quantitative scale to measure attitudes among Pre-service Teachers and adding the new dimension of 'education' to the three pillars of SD. The purpose of this study is to validate and adapt the quantitative scale developed by Biasuti and Frate (2017) for the Indian context to measure attitudes towards sustainable development among Pre-service Teachers. The Attitudes Toward Sustainable Development (ASD) scale is based on four dimensions: environment, economy, society, and education. The tool aligns with UNESCO's 2017 sustainability competencies, which emphasise knowledge acquisition and the development of attitudes and behaviours necessary for sustainable action. The validated tool aims to provide an empirical basis for evaluating Pre-service Teachers' understanding of sustainable development across social, economic, environmental, and education dimensions by providing a historical perspective on sustainable development and education, highlighting previous research on teacher training and Education for Sustainable Development integration, discussing key measurement tools, and the gap in Pre-service Teachers' attitude regarding Sustainable development.

### 2.1. Research Objective

To adapt and validate the Attitude towards Sustainable Development Scale developed by Biasuti and Frate (2017) in the Indian context.

## 3. METHODOLOGY

### 3.1. Participants

A quantitative cross-sectional research approach was used to validate Teacher Trainees' responses to the Attitude towards Sustainable Development (A quantitative cross-sectional approach was used to validate teacher trainees' responses to the Attitude towards Sustainable Development (ASD) scale. 450 B.Ed. Teacher trainees were asked to complete the questionnaire, but 25 were excluded due to missing data, leaving 415 valid responses (103 male, 312 female). The participants were final-year B.Ed. students from six colleges in Punjab, India. Data collection took place over four months and was divided into two groups: one for exploratory factor analysis and one for confirmatory factor analysis. The sample size was chosen to have about 10 respondents per item, which helps improve the KMO and Bartlett's test results for sampling adequacy. Larger sample sizes also make CFA fit indices (CFI, RMSEA, RMR, GFI) more accurate. (A Practical Introduction to Factor Analysis: Confirmatory Factor Analysis, n.d.) Enough participants were included to make the results generalizable. The study posed no risk to participants and received approval from the Institutional Ethics Committee. considered the following four dimensions: environment, economy, society, and education, as previously discussed. The current research differs from other studies because previous research was focused on the five types of learning: learning to be, learning to live together sustainably, learning to know, learning to do, and learning to transform oneself and society (Biasutti and Surian 2012). Alternatively, previous research focused on the following three UNESCO dimensions – environment, economy, and society – without considering education (Michalos et al. 2012; Olsson, Gericke, and Chang Rundgren 2015). The process of validating and adapting the attitude scale in this study was structured according to contemporary scale validation frameworks. Recent methodological guidelines emphasise a systematic approach that includes item refinement, content validation, construct validity, pilot testing, exploratory and confirmatory factor analyses and reliability assessment (DeVellis, 2017; Boateng et al., 2018; Worthington & Whittaker, 2006). The scale's validity was examined using various methods, including exploratory and confirmatory factor analyses and multi-group invariance

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testing. The KMO and Bartlett tests were also performed as part of the validity assessment. The KMO value of .830 indicates that the data are suitable for factor analysis.

Bartlett's Test of Sphericity showed that the correlation matrix was not an identity matrix, supporting the appropriateness of factor analysis. The results yielded a chi-square value of 1338.83 with 190 degrees of freedom (df) and a significance level of p = .000. An exploratory factor analysis (EFA) was conducted using a Varimax rotation to identify underlying factors and their relationships with observed variables. Factors with eigenvalues equal to or greater than one were considered, based on the Kaiser criterion and the Scree test. (Braeken & Assen, 2010, pp. 1-14) The EFA revealed a four-factor structure, each consisting of five items. These factors were named Environment, Economy, Society, and Education. Collectively, these factors explained 51.68% of the total variance in the scale. (Singh et al., 2022, pp. 218-225) These results provided strong evidence that the structure of the ASD scale remained consistent across the two samples.

### 3.2 Instrumentation

The original Attitude towards Sustainable Development scale was created by Michele Biasutti and Sara Frate (2017) in Italy for university students and included 20 items across four dimensions. The author of the current study received permission from the original authors to adapt the tool. A thorough literature review and expert feedback supported the choice to use and adapt this scale. The five-point Likert scale measures social, economic, environmental, and educational aspects of sustainable development. The ASD scale was given both online and offline. The original tool showed high content validity, as confirmed by experts in education, psychology, environmental education, and sustainability. Construct validity was demonstrated through an exploratory factor analysis, which confirmed that the items aligned with key sustainability areas, including social sustainability, local environmental issues, economic well-being, education, and global challenges. The original scale had a Cronbach's Alpha of .85, and the final 16-item version used in this study had a Cronbach's Alpha of 0.785, showing acceptable internal consistency.

## 4. Results and Data Analysis

This section covers the validation and psychometric properties of the ASD scale, giving an overview of the results and discussion. The tool's reliability and validity were tested using IBM SPSS Statistics 26 and AMOS 23. Descriptive statistics, Cronbach's alpha, exploratory factor analysis, KMO and Bartlett tests, and confirmatory factor analysis (CFA) were all used, following previous research. The findings are presented in several sections.

### 4.1 .Exploratory Factor Analysis

To explore the underlying factor structure of the adapted Attitude towards Sustainable development scale, Exploratory Factor Analysis (EFA) was conducted using Principal Component Analysis with Varimax rotation on a sample of 215, a sub-sample of B.Ed. teacher trainees out of 450. Construct Validity was established through Exploratory Factor Analysis (EFA). The EFA aimed to identify coherent dimensions that align with sustainable development domains in the context of teacher education. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were both examined prior to the analysis. The KMO value was > .80, and Bartlett's test was significant ($p < .001$), indicating that the data were suitable for factor analysis. The rotated component matrix yielded a four-factor solution, accounting for a substantial proportion of the variance and supporting the scale's multidimensionality. Factor loadings $\geq 0.45$ were considered significant (Hair et al., 2019).

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*Table 1.* **KMO and Bartlett's Test**

| Test | | Value |
|---|---|---|
| Kaiser–Meyer–Olkin Measure of Sampling Adequacy | | .787 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 674.384 |
| | *df* | 120 |
| | *p*-value | .000 |

The Kaiser-Meyer-Olkin (KMO) measure was 0.78, and Bartlett's Test of Sphericity was significant ($p < .001$), indicating sampling adequacy. Principal component analysis with varimax rotation revealed a three-factor structure, retaining 16 of 20 items after removing those with low loadings or cross-loadings. This result was consistent with the theoretical framework, as supported by multiple factor analyses. The results of the Total Variance Explained for the Attitude towards Sustainable Development (KSD) scale using Principal Component Analysis (PCA). The initial eigenvalues indicate that four components had eigenvalues greater than 1 (3.966, 1.638, 1.290, 1.197), cumulatively explaining 51% of the total variance. According to Kaiser's criterion, factors with eigenvalues above 1 are retained (Kaiser, 1960). Therefore, four factors were extracted from the analysis. The variance explained by the four components exceeds the minimum threshold of 40% recommended in social science research for acceptable construct validity (Hair et al., 2019). Therefore, the factor solution is statistically robust and supports the multidimensionality of the ASD construct.

**Table 2. Rotated Component Matrix for EFA (Principal Component Analysis with Varimax Rotation)**

| ASD Items | | | Factors | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | 1 | 2 | 3 | 4 |
| 1) When people interfere with the environment, they often produce disastrous consequences | 4.42 | 0.860 | | | .752 | |
| 2) Environmental protection and people's quality of life are directly linked | 4.47 | 0.675 | | | .606 | |
| 3) Biodiversity should be protected at the expense of industrial agricultural production | 3.67 | 0.917 | | .659 | | |
| 5) Environmental protection is more important than industrial growth | 4.13 | 0.783 | | .672 | | |
| 7) People should sacrifice more to reduce economic differences between populations | 3.65 | 0.969 | | .644 | | |
| 8) Government economic policies should increase fair trade | 4.13 | 0.808 | | | | .783 |
| 9) Government economic policies should act if a country is wasting its natural resources | 4.18 | 0.910 | | | | .735 |
| 10) Reducing poverty and hunger in the world is more important than increasing the economic well-being of the industrialized countries | 4.08 | 0.763 | | .510 | | |
| 11) Each country can do a lot to keep the peace in the world | 4.27 | 0.861 | | | .566 | |
| 12) The society should further promote equal opportunities for males and females | 4.51 | 0.791 | | | .592 | |
| 13) The contact between cultures is stimulating and enriching | 4.17 | 0.769 | | | | .562 |
| 15) The society should take responsibility for the welfare of individuals and families | 3.95 | 0.898 | .519 | | | |
| 16) Teachers in college should use student-centred teaching methods | 4.47 | 0.735 | .461 | | | |
| 18) Teachers in college should promote interdisciplinarity between subjects | 4.04 | 0.934 | .797 | | | |
| 19) Teachers in college should promote the connection between local and global issues | 4.18 | 0.818 | .717 | | | |
| 20) Teachers in college should promote critical thinking rather than lecturing | 4.28 | 0.960 | .757 | | | |

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### 4.1. Factor Interpretations

**Factor 1: Education**

This factor emphasises pedagogical aspects of sustainability, including interdisciplinarity, critical thinking, student-centred approaches, and links between global and local issues. These align with the principles of transformative education (UNESCO, 2017).

**Factor 2: Economic Sustainability**
This factor reflects concerns about equity, fair trade, responsible resource use, and poverty reduction. These items correspond to SDGs 1, 8, and 10, indicating respondents 'awareness of the economic dimension of sustainability.

**Factor 3: Environmental Sustainability**
Items loading on this factor relate to ecological impact, quality of life, and biodiversity protection, confirming conceptual alignment with SDGs 13–15.

**Factor 4: Social Sustainability**
This factor includes items on peacekeeping, gender equality, cultural enrichment, and social welfare, indicating a strong inclination toward social justice and inclusivity.

The EFA identified a four-factor structure that aligns well with both thematic pillars of sustainable development and the dimensions targeted in the tool. These results support the instrument's construct validity and lay the foundation for the subsequent Confirmatory Factor Analysis (CFA) with the second sub-sample (N = 200).

### 4.2. Confirmatory Factor Analysis (CFA)

To verify the factor structure obtained from EFA, CFA was performed on a separate sample of 200 participants using AMOS 23. Principal Factor Analysis estimation was applied. Model fit indices indicated an acceptable to good fit: CFI = .937, TLI = .926, RMSEA = .034. The model confirmed the latent structure of the scale measuring attitudes towards social, economic, and environmental aspects of sustainability.

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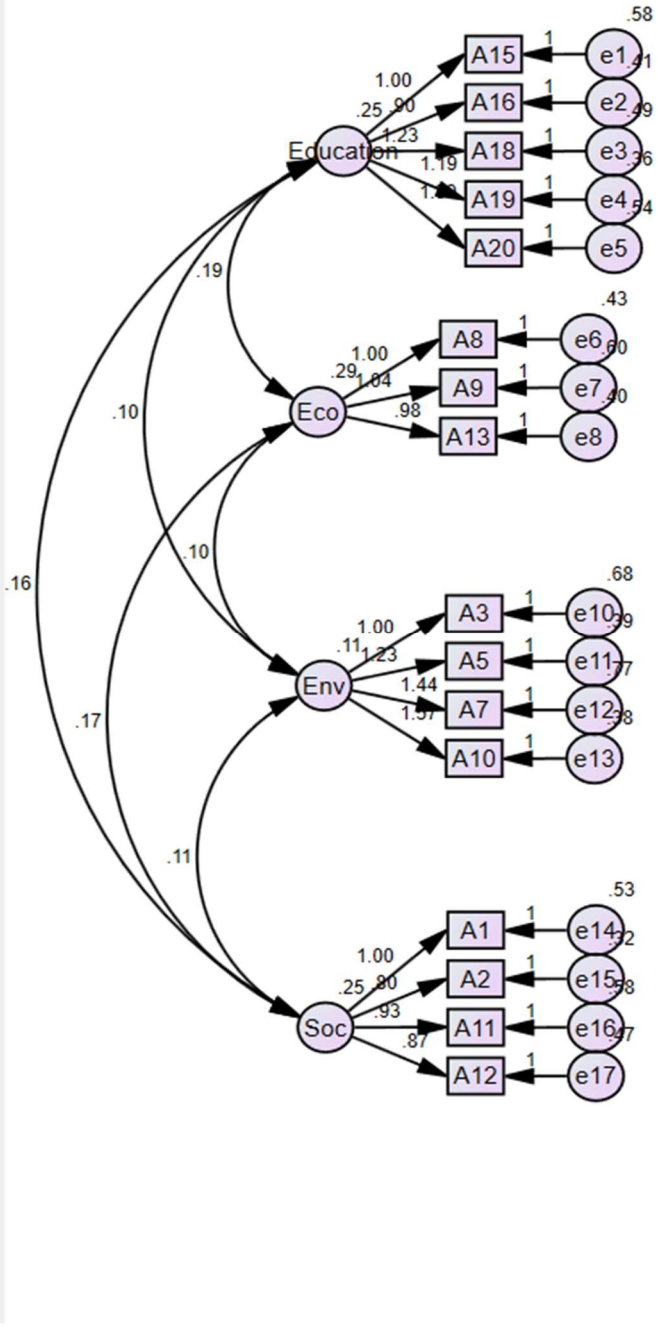
**Figure 1: CFA Path diagram of ASD (Attitude towards sustainable development)**




The confirmatory factor analysis supported a four-factor model comprising Education, Economic, Environmental, and Social dimensions. Standardized factor loadings ranged from 0.25 to 1.44, all statistically significant ($p < .001$). The latent constructs showed moderate intercorrelations, indicating acceptable discriminant validity. The model explained between 43% and 68% of the variance across constructs, confirming the adequacy of the measurement structure for assessing attitudes toward Sustainable Development.

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*Table 2: Model Fit Indices (CFA)*

| Fit Index | Value | Threshold | Interpretation |
|---|---|---|---|
| $\chi 2$/df (CMIN/DF) | 1.998 | < 3 | Good fit |
| GFI | .892 | > .90 | Acceptable fit |
| AGFI | .850 | > .80 | Good fit |
| CFI | .862 | > .90 | Acceptable (borderline) |
| TLI | .831 | > .90 | Moderate fit |
| RMSEA | .071 | < .08 | Acceptable |
| PCLOSE | .010 | > .05 | Borderline |
| AIC | 271.85 | Lower is better | Model comparison index |
| ECVI | 1.373 | ~1 or lower | Acceptable |
| Hoelter (0.05) | 124 | > 100 | Sample size adequate for 5% level |

These model fit indices suggest an acceptable overall fit between the hypothesized four-factor model and the observed data, thereby confirming the structure revealed through EFA.

### 4.3. Internal Consistency, Reliability, and Validity

Internal consistency for the full 16-item scale was acceptable (Cronbach's $\alpha = 0.785$), meeting the recommended threshold of $\geq 0.70$ (Netemeyer et al., 2003) as shown in Table 3 below.

**Table 3. Reliability Statistics of the validated ASD scale**

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .785 | .789 | 16 |

Along with the CFA fit indices, these results show that the adapted ASD scale is valid and reliable for research in Indian teacher education. Creating and testing this tool was more than a technical process; it prompted us to reconsider how teacher education can better prepare future educators for sustainability challenges. The findings show that Pre-service Teachers understand and have a positive attitude toward sustainable development, but their views on socio-economic and educational issues are less developed. (Lahari & K., 2024) This highlights both strengths and gaps in current teacher education. Including sustainability in the curriculum is a good step, but there is still a need for more practical, hands-on experiences to prepare teachers for real-world situations. (Thapa, n.d.) These results support earlier research calling for a holistic approach that includes attitudes, values, and behaviours, not just knowledge (UNESCO, 2017; Wals, 2020). The validated tool helps find knowledge gaps among Teacher Trainees and supports the aims of Sustainable Development Goal 4 (Quality Education), ESD, and related Sustainable Development Goals. (Jerslin et al., 2026) Its goal is to help learners gain the knowledge, attitudes, and skills needed for all four dimensions of attitudes toward sustainable development. However, the study shows that understanding and attitude alone are not enough. For teacher education to be truly sustainable, it should also foster critical thinking, empathy, teamwork, and the ability to act in complex and uncertain situations (Leicht et al., 2018).

## 5. Discussion

This study adapted and validated the Attitudes towards Sustainable Development (ASD) Scale for future teachers in Punjab, India. The results show that teacher trainees' attitudes toward sustainable development encompass four areas: environmental, social, economic, and educational sustainability. These areas support the idea that Education for Sustainable Development (ESD) is multidimensional and match UNESCO's competency-based approach to sustainability education.

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The exploratory and confirmatory factor analyses supported the four-part structure. (Design and Validation of a Scale for Teacher Educators' Conceptions Regarding Education for Sustainable Development, 2023) Aligning with the environmental, social, and economic areas matches earlier studies, but adding education as a separate part builds on past models and shows how important teacher education is for achieving Sustainable Development Goal 4. (SK, 2025) This means that future teachers see education as a way to shape sustainable habits, encourage social responsibility, and create lasting change in society. (Khadim et al., 2021, pp. 188-206)

Removing four items during validation underscores the importance of adapting research tools to local contexts. Tools made for one culture may not work the same way in another. The items left out did not align with the experiences of Indian teacher trainees, suggesting that attitudes toward sustainability depend on local education, culture, and environment. This shows why it is better to use measurement tools that fit the local context rather than those made for Western settings. (Lahari & K., 2024)

This study adds to ESD research by offering a validated tool made for Indian pre-service teachers. Many studies have examined sustainability awareness among university students, but fewer have focused on teacher trainees. (Singh-Pillay & Naidoo, 2024) Teacher trainees are important because they help bring sustainability ideas into the classroom. As future teachers, they shape how the next generation learns and uses these concepts. (García-González et al., 2020)

In practice, the validated scale can be used to assess and evaluate B.Ed. programs. Teacher educators can use it to find areas where trainees need more support in sustainability and plan specific interventions. The scale can also help review the curriculum, evaluate programs, and track how well ESD is included in NEP 2020 and SDG 4. Policymakers can use it to assess the effectiveness of sustainability efforts in teacher education institutions. (SK, 2025).Although this study makes important contributions, it has some limitations. The sample only included future teachers from Punjab, so the results may not apply to other parts of India. The study did not check if the scale works the same way for different groups. Future research should test the scale across different languages and cultures, follow participants over time, and examine how attitudes, knowledge, and behaviour are interconnected.

## 6. Conclusion

This study adapted and validated the Attitudes towards Sustainable Development Scale for future teachers in India. The final 16-item tool was validated and standardized after item refinement and factor analysis, showing good reliability and strong construct validity. Its four-factor structure—covering environmental, social, economic, and educational aspects—offers a robust framework for assessing sustainability attitudes among teacher trainees. This study makes several key contributions. First, it fills a gap in research on Education for Sustainable Development in India by providing a measurement tool suited to teacher education. Second, it builds on earlier frameworks by treating education as a distinct, measurable component of sustainable development. Third, it offers educators and policymakers a practical tool for curriculum planning, program evaluation, and policy work related to SDG 4 and the NEP 2020. The findings reinforce the view that achieving sustainable development requires more than the inclusion of sustainability topics within current curricula. Teacher education programs also need to build attitudes and mindsets among Pre-service Teachers that help them become leaders for sustainable change. By offering a reliable, culturally relevant assessment tool, this study lays the groundwork for future research and practical steps to improve Education for Sustainable Development among Pre-service Teachers across demographic groups and to examine how sustainability attitudes influence classroom practices and sustainability-related behaviour among teachers. Such developments would enable a comprehensive psychometric toolkit for evaluating ESD progress in teacher preparation programmes nationwide.

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