

Development and Validation of an Attitude Scale towards Sustainable Development for Middle School Students *

Ortaokul Öğrencilerine Yönelik Sürdürülebilir Kalkınma Tutum Ölçeği: Geçerlik ve Güvenirlik Çalışması

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ABSTRACT: This study aims to develop the “Attitude Scale Towards Sustainable Development” (ASTSD), which covers the cognitive, affective, and behavioral dimensions, to determine middle school students' attitudes towards sustainable development within the framework of sustainable development education. The research was conducted using a survey model, and the study group consists of 757 students attending various middle schools in a city in the Central Anatolia Region during the 2022-2023 academic year. The scale items were developed considering the 17 Sustainable Development Goals set by the United Nations, and data were collected for validity and reliability analyses through expert opinions. In this process, in addition to descriptive statistics, exploratory and confirmatory factor analyses were performed, and the internal consistency coefficient, Cronbach's Alpha, was calculated. As a result, the developed ASTSD is designed as a 5-point Likert-type scale consisting of a total of 41 items. The affective dimension of the scale consists of 15 items, the behavioral dimension of 14 items, and the cognitive dimension of 12 items. Teachers can use ASTSD to assess middle school students' attitudes towards sustainable development from various perspectives.

Keywords: Attitude scale, middle school students, sustainable development.

ÖZ: Bu çalışmanın amacı, sürdürülebilir kalkınma eğitimi çerçevesinde ortaokul öğrencilerinin sürdürülebilir kalkınma konusundaki tutumlarını belirleyebilmek için bilişsel, duyuşsal ve davranışsal boyutları kapsayan “Sürdürülebilir Kalkınmaya Yönelik Tutum Ölçeği”ni (SKYTÖ) geliştirmektir. Araştırma, tarama modeliyle gerçekleştirilmiş olup, çalışma grubunu 2022-2023 eğitim-öğretim yılı itibarıyla Orta Anadolu Bölgesi’ndeki çeşitli ortaokullarda öğrenim gören 757 öğrenci oluşturmaktadır. Ölçek maddeleri, Birleşmiş Milletler’in belirlediği 17 Sürdürülebilir Kalkınma Amacı göz önünde bulundurularak oluşturulmuş ve uzman görüşleri doğrultusunda geçerlik ve güvenilirlik analizleri için veriler toplanmıştır. Bu süreçte, betimsel istatistiklerin yanı sıra açıklayıcı ve doğrulayıcı faktör analizi uygulanmış ve iç tutarlılık katsayısı olan Cronbach Alpha değeri hesaplanmıştır. Sonuç olarak, geliştirilen SKYTÖ, 5 dereceli Likert tipi bir ölçek olarak tasarlanmış olup, toplamda 41 maddeden oluşmaktadır. Ölçeğin duyuşsal boyutu 15, davranışsal boyutu 14 ve bilişsel boyutu ise 12 maddeden oluşmaktadır. SKYTÖ, öğretmenler tarafından ortaokul öğrencilerinin sürdürülebilir kalkınma tutumlarını farklı değişkenler açısından değerlendirmek amacıyla kullanılabilir.

Anahtar kelimeler: Ortaokul öğrencileri, sürdürülebilir kalkınma, tutum ölçeği.

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Over time, the unconscious exploitation of natural resources, the surge in consumption driven by increased production, and the economic and social transformations of the 20th century have placed significant pressure on the ecosystem. These developments, coupled with the growing awareness of the finite nature of natural resources, have played a pivotal role in shaping the discourse on sustainability (Bazin, 2012). The World Commission on Environment and Development formally introduced the term ‘sustainable development’ in its seminal 1987 report *Our Common Future*. In this landmark report, sustainable development is described as a strategic approach to progress that harmonizes the needs of today’s population with the rights and capacities of future populations (Altuntaş & Türker, 2012; Gladwin et al., 1995).

The current Science Education Curriculum (Ministry of National Education [MONE], 2018; 2024) emphasizes sustainable development as a key component of scientific literacy. It highlights the interconnection between individuals, society and the environment, fostering awareness of how sustainable practices contribute to both present and future well-being. This approach underscores the conscious and responsible use of natural resources while encouraging individuals to recognize the social, economic and environmental implications of their actions. Within the updated science curriculum, sustainability is embedded across various grade levels-particularly within the units related to energy, ecology and environmental responsibility-reflecting the growing importance of education for sustainable development. Accordingly, nurturing these principles from early childhood is essential to cultivating future generations who internalize and practice sustainable development as a lifelong value.

The international narrative surrounding sustainable development has been shaped and refined over time through key milestones and global agreements. The journey began with the 1972 Stockholm Conference, where the environmental consequences of human activities were first brought to international attention. This was followed by the 1987 Brundtland Report, which introduced the widely accepted definition of sustainable development and outlined the first global strategy for its implementation. The 1992 Rio Earth Summit further emphasized the integration of environmental concerns with developmental goals, proposing a comprehensive global action plan. In 1995, the Copenhagen Summit highlighted the vital link between sustainable development, social justice, and human rights. The 1997 Kyoto Protocol marked a major milestone by underscoring the need for global cooperation in addressing climate change. The 2000 Millennium Summit led to the formulation of the Millennium Development Goals (MDGs)—eight central targets aimed at eradicating poverty and fostering global development. The 2002 Johannesburg Summit reviewed the progress made since Rio and examined the effectiveness of sustainable development efforts. A decade later, the Rio+20 Conference (held in Brazil in 2012) promoted green economies and sustainable development, bringing together global leaders and civil society to ensure a livable planet for future generations. Building on these efforts, the 2015 United Nations "Transforming Our World" report, also known as the 2030 Agenda, introduced the 17 Sustainable Development Goals (SDGs). This comprehensive framework seeks to combat poverty, reduce inequality, address climate change, and establish a more just and sustainable world. The SDGs serve as a universal call to action for improving quality of life on a global scale and represent a pivotal step in mobilizing the

international community toward long-term sustainability (United Nations Development Programme, 2015).

The United Nations' 17 Sustainable Development Goals (SDGs) represent a comprehensive global agenda addressing the interdependence of social, economic, and environmental systems. Rather than examining these goals as separate entities, this study conceptualizes them as interconnected domains that collectively shape individuals' understanding, attitudes, and behaviors toward sustainability. The social goals (no poverty, gender equality, reduced inequalities, peace and strong institutions) emphasize inclusivity, justice, and social cohesion; the environmental goals (e.g., clean water and sanitation, affordable and clean energy, responsible consumption and production, climate action, life below water, and life on land) focus on the responsible management of natural resources and ecological balance; while the economic goals (decent work and economic growth, industry and innovation, and sustainable infrastructure) highlight productivity and equity through sustainable practices. Education for sustainable development (Goal 4) serves as a unifying framework linking these three dimensions by fostering cognitive understanding, affective engagement, and behavioral commitment toward sustainability. Within this perspective, the current research aligns with the SDG framework by aiming to measure students' attitudes—cognitive, affective, and behavioral—toward sustainability, reflecting how the principles embedded in the SDGs are internalized at the individual level.

Education is widely recognized as a key enabler for achieving the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015. Contemporary research highlights that education fosters the knowledge, values and competencies necessary for building sustainable societies (UNESCO, 2020; OECD, 2022; Wals & Corcoran, 2019). As sustainable development is closely linked to individuals' lifestyles and decision-making, it is crucial to formulate and implement educational policies that promote sustainability-oriented thinking and behavior at both national and global levels. Moreover, recent studies emphasize that education for sustainable development should be integrated across all disciplines and educational stages to ensure a holistic approach toward sustainability (Demir, 2021; Karataş & Kaya, 2023).

Sustainable development education refers to a pedagogical framework that empowers individuals with the necessary cognitive, affective, and behavioral competencies to fulfill their needs through innovative and forward-thinking approaches (UNECE, 2005). Its primary aim is to help students develop a well-rounded understanding of sustainability by addressing its cognitive, affective, and behavioral dimensions (Cebrian & Junyent, 2015). This educational approach encourages individuals to make informed decisions in alignment with the principles of sustainable development. Among its key objectives are increasing awareness about sustainability issues, instilling constructive values and attitudes, and cultivating appropriate behaviors through the enhancement of essential skills and abilities.

It is important to determine individuals' attitudes toward sustainable development education. This is because understanding the degree of an individual's attitude toward a situation is crucial, as it influences their behaviour and decision-making process. Understanding students' attitudes toward a situation helps teachers encourage students to develop positive attitudes toward a topic or lesson, or to change

their negative attitudes in a positive direction (Erkuş, 2003; Ülgen, 1996; Tavşancıl & Keser, 2002).

Considering these factors, it can be stated that the number of studies conducted on sustainable development education has expanded. Upon reviewing these studies, the following can be noted: studies conducted with teachers (Dal, 2020; Gürbüz, 2020; Özsoy, 2019); studies conducted with teacher candidates (Akgül, 2020; Aksan, 2016; Atmaca, 2018; Aydın, 2019; Burmeister & Eilks, 2013; Corney & Reid, 2007; Eilks, 2015; Keleş, 2007; Koçulu, 2018; Maidou, Plakitsi & Polatoglou, 2019; Nickel, 2007; Özsoy, 2021; Soysal, 2016); studies conducted with middle school students (Aydın & Çimer, 2021; Aytar, 2016; Birdsall, 2013; Boncukçu, 2020; Burkaz Ekinci, 2021; Çetin, 2015; Demirtaş & Çinici, 2019; Dursun, 2022; Erkol, 2019; Kanmaz, 2019; Peterson & Alkış, 2009; Şeker, 2018; Walshe, 2008); scale development studies conducted at the middle school level (Akgül & Aydoğdu, 2020; Kaya, 2013); scale development studies with teacher candidates (Afacan & Demirci Güler, 2011; Türer, 2010); scale development studies with teachers (Sağdıç, 2013; Sağdıç & Şahin, 2015). Previous investigations within the realm of sustainable development education primarily targeted both prospective teachers and those currently employed in the profession.

However, despite the growing body of literature, limited research has been conducted in line with the expectations of the 2024 Science Curriculum, which places a stronger emphasis on sustainability as a literacy component and integrates sustainability-related competencies across learning areas. This gap highlights the need for updated and contextually relevant measurement tools that can evaluate how middle school students' attitudes and competencies align with the sustainability goals embedded in the current curriculum. Therefore, the present study aims to contribute to this need by developing an attitude scale grounded in the 2024 curriculum's sustainability vision.

In this context, there is a noticeable scarcity of scale development studies targeting middle school students; however, this gap carries significant pedagogical and theoretical implications. The middle school period represents a critical developmental stage during which individuals' values, habits and environmental awareness begin to take shape. Therefore, measuring attitudes toward sustainable development within this age group is essential for evaluating the effectiveness of educational practices and for designing programs that foster sustainable thinking and behavior. Grounded in the United Nations Sustainable Development Goals (SDGs), the present study aims to develop the "Attitude Scale Towards Sustainable Development", providing a valid reliable instruments that contributes to both theoretical understanding and practical applications in sustainability education.

Method

Research Model

This research was conducted using a descriptive survey model, which is designed to assess existing or past situations without manipulating any variables. In this approach, the phenomena, individuals, or objects are described in their natural state (Karasar, 2002). The primary objective of the study is to create a reliable and valid scale that can measure students' attitudes toward sustainable development accurately.

Study Group

This study focuses on middle school students who were enrolled in educational institutions within Niğde province in the 2022–2023 academic years. The study sample consists of 757 students selected from various middle schools in the Bor district of Niğde. Of the middle school students, 361 (48%) are female, and 396 (52%) are male. In this study, simple random sampling, a type of non-random sampling, was preferred. Simple random sampling is a method that ensures each unit is selected with an equal probability, determining the units included in the sample group (Büyüköztürk et al., 2016). In determining the sample size, 10% of the total student population was selected. Furthermore, the sample was deemed sufficient based on the widely accepted criterion of having at least ten participants per item on the measurement scale (Pallant, 2017).

Data Collection Tools

Attitude Scale Towards Sustainable Development

The process of developing the attitude scale in this study was structured in accordance with contemporary scale development frameworks. Recent methodological guidelines emphasize a systematic approach that includes item generation, content validation, pilot testing, exploratory and confirmatory factor analyses and reliability assessment (DeVellis, 2017; Boateng et al., 2018; Worthington & Whittaker, 2006). The steps followed in this study are detailed below.

Item Generation. For the purpose of measuring middle school students' attitudes toward sustainable development, an initial pool of scale items was generated as part of this study. Determining the objective of the attitude scale constitutes the foundational step in ensuring its validity and reliability throughout the development process. The research problem must be well defined, and the objectives of the study should be specified in detail (Büyüköztürk et al., 2016). To achieve the stated aim, an extensive review of the relevant literature was carried out, and a conceptual framework was established to guide the development of a scale with strong psychometric properties in terms of validity and reliability. The item pool was created based on studies by Afacan and Demirci (2011), Akgül (2020), Aytar (2016), Biasutti and Frate (2017), Çimer and Aydın (2018), Kaya (2013), Kuvaç (2018), Türer (2010), and the set of 17 Sustainable Development Goals (SDGs) adopted by the United Nations as part of the 2030 Agenda. This pool consists of 51 attitude items. The creation of the item pool was guided by the United Nations Sustainable Development Goals (SDGs) and the three-component attitude model (Kağıtçıbaşı, 1999), which integrates cognitive, affective and behavioral dimensions. Each item was designed to reflect one or more of the 17 SDGs within the framework of sustainability education. For instance, items addressing responsible consumption and production (SDG 12), climate action (SDG 13), quality education (SDG 4) were developed to capture cognitive awareness, affective sensitivity and behavioral intention respectively. This mapping ensured that the scale items were theoretically grounded in the principles of sustainable development while maintaining internal consistency among the attitude components. Accordingly, if the individual's knowledge about a subject fosters a positive perspective, this is considered the cognitive component; if the individual displays a positive attitude towards the subject, this is the affective component; and if the individual expresses their thoughts through words and

actions, this is considered the behavioral component (İnceoğlu, 2010). A 5-point Likert scale, designed to reflect varying degrees of agreement, was administered to gather participants' responses to the items (Tavşancıl, 2002).

Expert Opinion. To evaluate the relevance of the 51 attitude items prepared, the opinions of two domain experts specialized in biology, environmental science, science and sustainable development education were sought. Based on expert feedback, several revisions were made to enhance the clarity, content validity, and theoretical coherence of the scale. Specifically, ambiguous or overlapping items were rephrased for clarity, and three items were removed due to redundancy. Some items were revised to ensure stronger alignment with their respective Sustainable Development Goals (SDGs). For example, items that originally assessed general environmental awareness were refined to explicitly reflect SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). Certain items were also modified to better match the cognitive level of middle school students, while new items emphasizing individual and social responsibility behaviors were added to the behavioral component. In addition, linguistic accuracy and age appropriateness were reviewed based on the recommendations of a language expert. Furthermore, recognizing that sustainable development is a multidisciplinary concept encompassing environmental, economic, and social dimensions, expert opinions were obtained from specialists in environmental sciences, social sciences, and educational sciences. These comprehensive revisions substantially strengthened the theoretical consistency, content validity, and the scale's ability to reflect the multidimensional nature of sustainability.

Pilot Testing. A pilot testing was conducted with 150 middle school students to assess the clarity and comprehensibility of the scale items related to attitudes toward sustainable development. The students were instructed to highlight the items that posed comprehension difficulties. These expressions were reviewed again based on expert opinions, appropriate modifications were carried out, and the scale was finalized for deployment in the main study. Additionally, considering the students' response times, the time required to complete the scale was calculated and set at 35 minutes. Although this duration was sufficient for students to carefully read and respond to all items, potential attention fatigue among middle school participants was taken into consideration. To minimize this risk, the administration was conducted under supervised classroom conditions, and students were informed that they could request short pauses if needed. Moreover, the instructions were simplified and read aloud by the researcher to ensure consistent understanding and maintain engagement throughout the process. Feedback from the pilot implementation indicated that most students were able to complete the scale comfortably within the allocated time without showing signs of fatigue or inattention. However, for lower grade levels, the researchers acknowledge that future applications may consider further reducing the number of items or dividing the administration into two shorter sessions to maintain optimal response quality.

Factor Analysis and Reliability Study. The initial version of the scale was applied to 757 middle school students. During data processing, missing responses from 18 participants were identified and excluded, leaving a final sample size of 739 students for analysis. In order to validate the scale's structure, EFA was employed, and items failing to meet acceptable factor loading criteria were excluded. The reliability of the

scale was then evaluated through Cronbach's Alpha analysis. All statistical procedures were conducted using SPSS software. Moreover, CFA was performed using LISREL software to verify the factor structure revealed by EFA. The findings section provides a comprehensive presentation of the results obtained from this analysis.

After identifying the factors, an attempt was made to assign them based on the expressions of the items within each factor. Attitudes consist of three basic components: cognitive, affective, and behavioral. These three components must be interconnected. If a person provides information about a subject, this reflects the cognitive component; the emotional approach exhibited towards the subject reflects the affective component; and how the person will behave towards the subject reflects the behavioral component. Their attitude determines a person's response to a situation. The concept of attitude has gained prominence in the field of education over time through theoretical developments and methodologies, making it more prominent in related studies (İnceoğlu, 2010).

As the items in the first dimension relate to affective characteristics, the first factor has been named the "Affective Dimension." Since the second dimension is related to behavioral characteristics, it has been named the "Behavioral Dimension." The third dimension, which expresses cognitive characteristics, has been named the "Cognitive Dimension."

Factor 1: Affective Sub-Dimension Items: 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34

Factor 2: Behavioral Sub-Dimension Items: 35, 36, 37, 38, 39, 40, 41, 42, 44, 47, 48, 49, 50, 51

Factor 3: Cognitive Sub-Dimension Items: 1, 2, 3, 6, 7, 8, 9, 10, 12, 13, 14, 15

Data Collection Process

Following approval from the Ethics Committee of the Faculty of Social and Human Sciences Erciyes University (Approval No: E-66777842-300-00003075448, dated 28/09/2022), an application was submitted to the Niğde Provincial Directorate of National Education, which will oversee the conduct of the research. Based on the official research permission granted, communication was established with school psychological counselors at the designated schools. Information about the study was conveyed through the school counselors. Parental consent forms and student information forms were distributed and collected through these counselors. Data collection was conducted by the principal researcher, who visited the schools at the dates and times arranged by the school administration, gathering responses from volunteer participants.

Findings

The research findings are detailed in this section in an organized manner aligned with the study's aims.

Exploratory Factor Analysis of the Scale

The attitude scale designed to evaluate middle school students' views on sustainable development was organized into three key dimensions. To investigate the scale's underlying factor structure, EFA was conducted. EFA is a statistical technique

used to identify clusters of items within factors and to clarify the interrelationships among these items. Through this analysis, it is expected that the scale items will cluster under certain sub-factors or dimensions (Seçer, 2017). Pallant (2017) describes factor analysis as a statistical technique used to reduce large sets of variables into smaller, interpretable components, thereby contributing to the assessment of a measurement instrument's construct validity.

Prior to conducting the EFA, the adequacy of the sample size was assessed using the Kaiser-Meyer-Olkin (KMO) test, and the suitability of the data for normal distribution was evaluated through Bartlett's Test of Sphericity. For the 51-item Attitude Scale Toward Sustainable Development (ASTSD), the KMO value was found to be 0.956, and Bartlett's test result was significant ($\chi^2_{1275} = 18480.68$; $p < 0.01$). A KMO value greater than 0.60 and a significant Bartlett's Test indicate that the data are suitable for factor analysis (Pallant, 2017; Tabachnick & Fidell, 2007).

In EFA, the factor loading of each item indicates the degree of its association with the corresponding factor. Pallant (2017) suggests that an item should have a minimum factor loading of 0.30 to be considered linked to a factor. In this study, all items met this criterion, with none falling below 0.30. When an item loads on multiple factors with loadings of 0.30 or higher, a minimum difference of 0.10 between these loadings is necessary to prevent cross-loading. Based on this rule, items 5, 11, 17, 43, 45, and 46 were identified as cross-loading and thus removed from the scale. Following their removal, the updated scale comprised 45 items. A subsequent EFA was performed on this revised version, yielding a KMO value of 0.961 and a significant Bartlett's Test result ($\chi^2_{990} = 16328.49$; $p < 0.01$).

As the final scale structure included multiple interrelated factors, the oblique rotation technique Direct Oblimin was applied to allow for factor correlation. Following the removal of problematic items, the factor analysis was repeated using the Direct Oblimin technique. The total variance explained by the factors is presented in Table 1.

Table 1

Total Variance Explained for the Attitude Scale Toward Sustainable Development

Components	Initial Eigenvalues		
	Total	Percentage of Variance	Cumulative Percentage
1	16.196	35.991	35.991
2	2.522	5.605	41.596
3	1.523	3.385	44.980
4	1.387	3.082	48.062
5	1.247	2.771	50.833
6	1.164	2.586	53.420
7	1.064	2.364	55.784
8	.960	2.133	57.916
9	.931	2.068	59.985
10	.880	1.955	61.940

11	.849	1.886	63.826
12	.806	1.790	65.616
13	.794	1.765	67.381
14	.755	1.679	69.060
15	.724	1.609	70.669
16	.690	1.534	72.202
17	.675	1.501	73.703
18	.653	1.452	75.155
19	.624	1.387	76.542
20	.597	1.328	77.870
21	.587	1.304	79.174
22	.563	1.250	80.424
23	.550	1.222	81.646
24	.513	1.139	82.785
25	.507	1.128	83.913
26	.485	1.078	84.991
27	.477	1.059	86.050
28	.459	1.020	87.070
29	.450	.999	88.069
30	.431	.957	89.026
31	.419	.932	89.958
32	.413	.917	90.874
33	.393	.874	91.749
34	.379	.843	92.591
35	.375	.834	93.426
36	.362	.803	94.229
37	.346	.770	94.999
38	.326	.725	95.724
39	.319	.708	96.432
40	.313	.695	97.127
41	.293	.650	97.778
42	.281	.625	98.402
43	.266	.592	98.994
44	.236	.524	99.518
45	.217	.482	100.000

The scale was developed based on three sub-factors: cognitive, affective, and behavioral dimensions, which reflect the multidimensional structure of attitudes toward sustainable development. This tripartite model aligns with the literature emphasizing

that sustainable development should be understood not only in terms of knowledge but also in terms of values, attitudes, and actions (UNESCO, 2017; Shephard, 2008). Previous studies examining attitudes or competencies related to sustainability have also employed similar dimensions (Biasutti & Frate, 2017; Michalos et al., 2012). Thus, the three-dimensional structure of the scale is supported both theoretically and empirically.

When examining Table 1, the contributions of the three factors to the total variance are as follows: the first factor contributes 35.99%, the second factor contributes 5.60%, and the third factor contributes 3.38%. The combined contribution of these three factors to the total variance is 44.98%. This percentage is considered an adequate level of explained variance. However, different limits are suggested in the literature for the explained variance, Scherer et.al., (1988) state that for scales consisting of multiple factors, the variance value should be between 40% and 60%. In contrast Kline (2011) suggests that the items of the scale should explain at least 40% of the total variance.

Furthermore, the line graph illustrates the three-factor structure of the scale. Factor loadings for the 45-item ASTSD ranged from .388 to .777 for the first factor, .390 to .661 for the second factor, and .458 to .750 for the third factor. Based on the exploratory factor analysis, items 4 and 25 were excluded due to their failure to load significantly on any factor. Additionally, items 16 and 24 were removed following expert review, as they did not correspond with the predefined theoretical framework.

In the scale development process, it is not enough to examine the total variance table; it is also necessary to analyse the "Scree Plot" graph to evaluate the factor structure of the scale (Seçer, 2017). The "Scree Plot" graph is provided below in Figure 1.

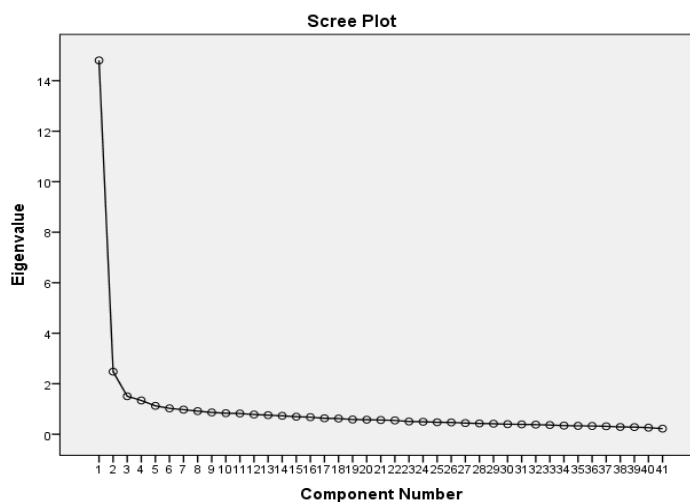


Figure 1

Scree Plot of the Sustainable Development Attitude Scale

The Scree Plot of the developed scale is shown in Figure 1 above, and this graph presents a view that aligns with the results obtained for explaining the total variance. Considering that the drop between two points after the inflection point on the graph represents a factor, it can be understood that after the third factor, the contribution of the factors to the variance becomes very similar. The horizontal trajectory of the curve after this point supports the decision to set the number of factors to three (Çokluk et al.,

2010). After factor analysis, the "rotated component matrix" table is examined to determine which factor each item clusters under (Seçer, 2017). Table 2 offers a comprehensive breakdown of how the scale items are distributed across the three factors.

Table 2

Rotated Component Matrix of the Sustainable Development Attitude Scale

Items	Factors		
	1	2	3
SK18	.386		
SK19	.426		
SK20	.437		
SK21	.578		
SK22	.595		
SK23	.516		
SK26	.435		
SK27	.699		
SK28	.627		
SK29	.675		
SK30	.744		
SK31	.767		
SK32	.776		
SK33	.598		
SK34	.445		
SK35		.485	
SK36		.653	
SK37		.533	
SK38		.578	
SK39		.629	
SK40		.650	
SK41		.493	
SK42		.611	
SK44		.418	
SK47		.571	
SK48		.593	
SK49		.458	
SK50		.620	
SK51		.657	
SK1			.485

SK2	.467
SK3	.617
SK6	.691
SK7	.597
SK8	.557
SK9	.723
SK10	.402
SK12	.588
SK13	.673
SK14	.683
SK15	.688

Table 2 demonstrates that the scale includes three clearly differentiated factors, with all items loading above 0.30 and no evidence of cross-loadings. After the factor analysis, items grouped under the same factor were evaluated, and appropriate names were given to each factor. Upon examining the first dimension, it was observed that the items in the scale are related to emotional characteristics, and therefore, the first factor was named "Affective Dimension." Since the second dimension is related to behavioral characteristics, this factor was named "Behavioral Dimension." Upon examining the third dimension, which reflects cognitive characteristics, it was named the "Cognitive Dimension." The distribution of the scale items according to their factors is given in Table 3.

Factor 1: Affective Sub-Dimension; Items 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34

The items included in Factor 1 are listed as follows; Helping poor people makes me happy, growing food organically makes me happy, having access to necessary healthcare when I am sick makes me happy, the fact that all children have the right to equal education gives me hope, all kinds of violence make me sad, waste of water makes me sad, industrialisation that does not harm the environment brings me happiness, discrimination among people makes me sad, everyone living in a safe home makes me feel peaceful, food waste makes me feel upset, the adverse effects of climate change scare me, the pollution of the seas worries me, afforestation efforts make me happy, living in a safe environment makes me feel peaceful, the assistance provided by developed countries to underdeveloped countries brings me happiness.

Factor 2: Behavioral Sub-Dimension; Items 35, 36, 37, 38, 39, 40, 41, 42, 44, 47, 48, 49, 50, 51

The items included in Factor 2 are listed as follows; I help people living in poverty, I strive to eat healthily, I get vaccinated against epidemic diseases, I help my disabled friends in the educational environment, I fulfill my responsibilities within the family, I do not waste water, I turn off the lights when they are not needed, I study hard in my lessons to avoid being unemployed in the future, I do not discriminate among people, I do not use deodorant because I believe it harms the environment, I do not pour waste oil down the drain because it pollutes the water, I do not harm trees, I warn people

who use violence, I fulfill my responsibilities for my country to become a developed nation.

Factor 3: Cognitive Sub-Dimension; Items 1, 2, 3, 6, 7, 8, 9, 10, 12, 13, 14, 15

The items included in Factor 3 are listed as follows; I think that helping people experiencing poverty is necessary, I believe that everyone in society should have proper nutrition, I think measures should be taken to reduce the death rate in traffic accidents, I know that water pollution should be prevented, I am aware that energy-saving devices should be used everywhere, I am aware that unemployment should be prevented, I am aware that environmentally friendly technologies should be used in industrial facilities, I believe that discrimination among people should be eliminated, I believe that waste should be recycled, I am aware of what climate change can cause, I think it is necessary to protect the seas, I believe that the life in the forest should be protected.

Confirmatory Factor Analysis for the Scale

Confirmatory factor analysis (CFA) was conducted to assess the validity of the proposed three-factor structure. The analysis utilized data from a sample of 220 participants and was performed using the LISREL software. Fit indices, factor loadings, and regression coefficients were examined in detail during the evaluation process.

In CFA, various fit indices are used to assess the model's adequacy. Among these indices, the Chi-square (χ^2) value is considered an important indicator. The analysis resulted in $\chi^2 = 1773.67$, $df = 776$, $p = .000$, and $\chi^2/df = 2.28$. According to the literature, a value below 3 signifies a good structural fit for the model (Seçer, 2017). In this regard, the obtained value of 2.28 indicates an excellent model fit. Furthermore, to thoroughly evaluate the accuracy of the three-factor structure, the model fit indices were examined for comparative analysis.

Table 3

Fit Index Table for the Sustainable Development Attitude Scale

Fit Indices	Criteria for Excellent Fit	Criteria for Acceptable Fit	Achieved Values
Chi-square/Degrees of Freedom (χ^2/df)	$0 \leq \chi^2/df \leq 2$	$2 \leq \chi^2/df \leq 3$	2.28
Root Mean Square Error of Approximation (RMSEA)	$.00 \leq RMSEA \leq .05$	$.05 \leq RMSEA \leq .08$	0.078
Normed Fit Index (NFI)	$.95 \leq NFI \leq 1.00$	$.90 \leq NFI \leq .95$	0.91
Comparative Fit Index (CFI)	$.95 \leq CFI \leq 1.00$	$.90 \leq CFI \leq .95$	0.95
Goodness of Fit Index (GFI)	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI \leq .95$	0.70
Adjusted Goodness of Fit Index (AGFI)	$.90 \leq AGFI \leq 1.00$	$.85 \leq AGFI \leq .90$	0.67

According to the data obtained in Table 3, it can be stated that the model is validated and that the fit index results are within acceptable threshold levels. The fit values were calculated as $RMSEA = .078$, $RMR = .058$, and $SRMR = .068$. These values indicate an acceptable fit, as they fall between .05 and .08 (Schumacher & Lomax, 2004). The CFA results support the findings of the EFA, confirming that the

scale is composed of three distinct factors. The model diagram representing these results is shown in Figure 2.

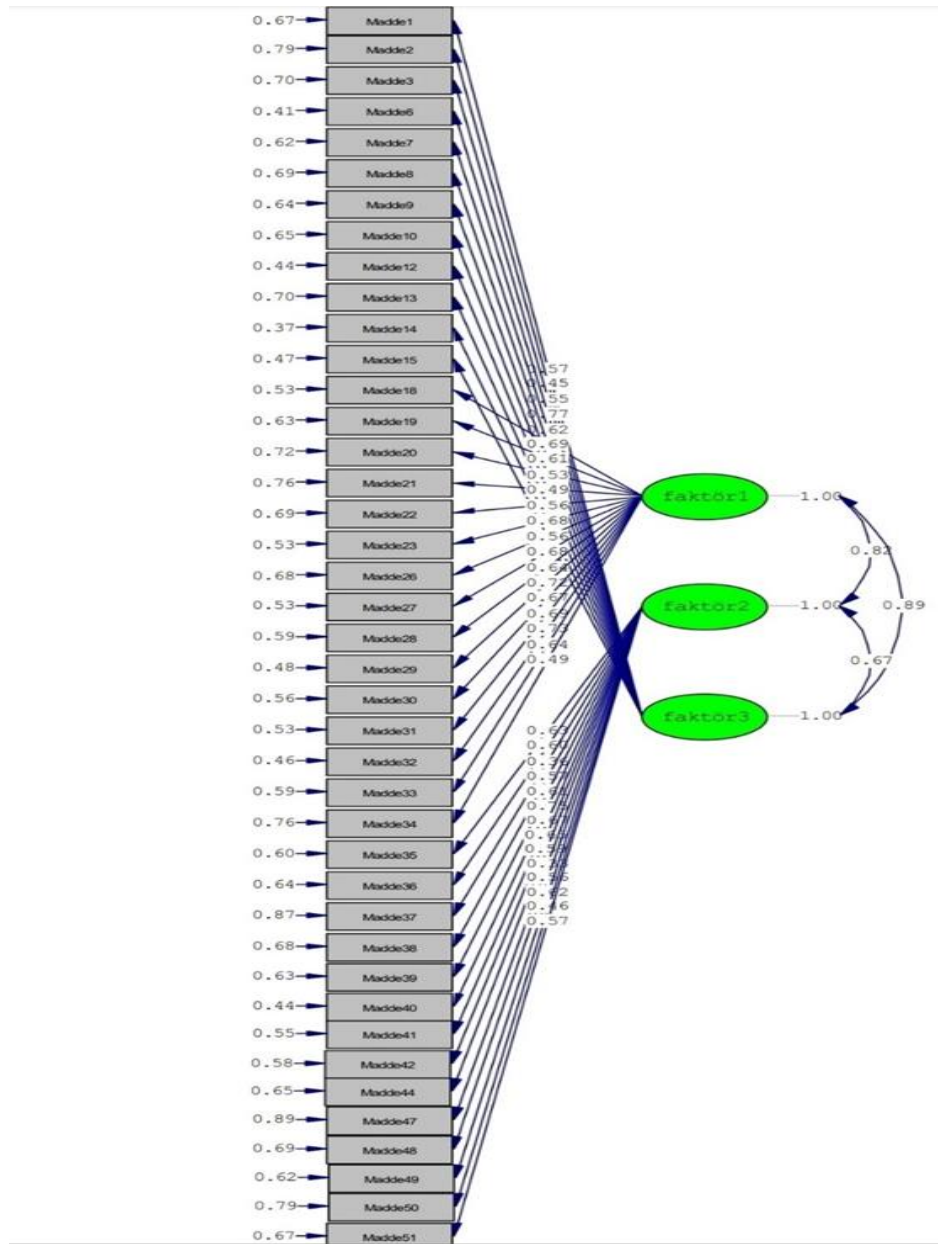


Figure 2

Path Diagram of the Sustainable Development Attitude Scale

Reliability Analysis for the Scale

The internal consistency of the attitude scale was evaluated through Cronbach's Alpha coefficient, which measures how closely related the items are within the scale. A reliability coefficient of 0.70 or above is generally accepted as indicating sufficient reliability (Büyüköztürk, 2016). The reliability coefficients for each subdimension as well as for the entire scale are summarized in Table 4.

Table 4

Cronbach's Alpha Coefficients for the Scale

Factors	Number of items	Cronbach's alpha (α)
Affective	15	.91
Behavioral	14	.88
Cognitive	12	.88
Total Scale	41	.95

As presented in Table 4, the Cronbach's Alpha values for the affective, behavioral, and cognitive sub-dimensions were 0.91, 0.88, and 0.88, respectively. For the entire 41-item attitude scale, the Cronbach's Alpha coefficient was found to be 0.95. These results suggest that the scale possesses strong internal consistency and is a reliable tool for measurement.

Item Analysis Based on the Comparison of Lower and Upper Group Item Means

Within the scope of this analysis, item discrimination and selection for the Attitude Scale towards Sustainable Development (ASTSD) were assessed by calculating average scores for each student. An independent samples t-test was performed to compare the item scores between the highest 27% (26 students) and lowest 27% (29 students) groups. The results showed statistically significant differences in mean scores for all 41 items ($p < .01$), with t-values ranging from 3.50 to 4.80. These findings demonstrate that the scale items exhibit strong discriminatory power.

Item Analysis Based on Correlation

This method examines the relationship between each item score and the total score in the ASTSD. A high and positive correlation indicates that the item behaves consistently with the overall scale. In general, a correlation coefficient above .20 is expected (Büyüköztürk, 2016). As shown in Table 5, the item-total correlation coefficients for all items are statistically significant ($p < .01$), and the correlation values are above .50, demonstrating a strong relationship between each item and the overall scale.

Table 5

Item Analysis Results of the Scale

Item	Item Correlation	Item	Item Correlation
SK1	.674	SK22	.736
SK2	.608	SK23	.575
SK3	.625	SK24	.627
SK4	.592	SK25	.703
SK5	.513	SK26	.758
SK6	.504	SK27	.602

SK7	.529	SK28	.643
SK8	.552	SK29	.528
SK9	.727	SK30	.509
SK10	.674	SK31	.673
SK11	.658	SK32	.749
SK12	.567	SK33	.708
SK13	.655	SK34	.612
SK14	.612	SK35	.728
SK15	.573	SK36	.678
SK16	.681	SK37	.404
SK17	.592	SK38	.504
SK18	.805	SK39	.781
SK19	.767	SK40	.668
SK20	.653	SK41	.684
SK21	.670		

Conclusion, Discussion, and Recommendations

In this research, the Attitude Scale Towards Sustainable Development (ASTSD) was developed to assess middle school students' attitudes toward sustainable development across three interrelated domains: cognitive, affective, and behavioral. The findings obtained from the Exploratory and Confirmatory Factor Analyses (EFA and CFA) confirmed a robust three-factor structure that aligns with the tripartite attitude model proposed by Kağıtçıbaşı (1999) and further supported by contemporary attitude theories (Eagly & Chaiken, 2007; DeVellis, 2017). The internal consistency coefficients ($\alpha = .88$ for cognitive, $.91$ for affective, and $.88$ for behavioral; $\alpha = .95$ overall) indicate strong reliability, confirming that the ASTSD is a psychometrically sound instrument for measuring sustainability-related attitudes among adolescents.

Beyond the statistical findings, the theoretical framework of the ASTSD provides a novel interpretation of sustainability education. Unlike previous instruments that predominantly structured sustainable development around social, environmental, and economic pillars (Kaya, 2013; Biasutti & Frate, 2016; Akgül & Aydoğdu, 2020), the ASTSD approaches sustainability through the psychological lens of attitude formation. The cognitive dimension corresponds to students' awareness and conceptual understanding of sustainability and global issues such as resource use, equity, and environmental protection. The affective dimension encompasses emotional engagement, sense of responsibility, and empathy toward humans and nature, while the behavioral dimension captures concrete actions and self-reported practices aligned with sustainability principles. This reconceptualization reflects a shift from perceiving sustainability as a set of external domains toward understanding it as an internalized, multidimensional construct that drives individual and collective transformation.

From a theoretical standpoint, these three dimensions also demonstrate a meaningful correspondence with the United Nations Sustainable Development Goals (SDGs). The cognitive domain aligns with SDGs such as *Quality Education (Goal*

4) and *Responsible Consumption and Production (Goal 12)*, emphasizing awareness and informed decision-making. The affective domain corresponds to *Gender Equality (Goal 5)*, *Reduced Inequalities (Goal 10)*, and *Peace, Justice, and Strong Institutions (Goal 16)*, which require empathy, ethical values, and emotional commitment. The behavioral domain reflects actions connected to *Sustainable Cities and Communities (Goal 11)* and *Climate Action (Goal 13)*, where individual behavior translates into social change. This mapping provides a clear theoretical justification for the selection of the three components and underscores the alignment between the ASTSD and global educational priorities in sustainability.

In addition, the ASTSD differs from existing instruments by explicitly operationalizing the interrelationship among these three dimensions. While the social–environmental–economic model conceptualizes sustainability in terms of external systems, the cognitive–affective–behavioral model captures the psychological processes that enable individuals to internalize and act upon sustainability principles. This internal focus complements macro-level frameworks, bridging the gap between education for sustainable development (ESD) policies and individual student engagement. It also resonates with the 2024 revised national curriculum, which positions sustainability as a cross-disciplinary literacy area, emphasizing not only knowledge acquisition but also value formation and responsible behavior.

Furthermore, the findings contribute to both theoretical and practical dimensions of sustainability education. Theoretically, the ASTSD provides an evidence-based tool for exploring how cognitive awareness translates into behavioral change through affective engagement. It supports models such as the *Value-Belief-Norm Theory* (Stern, 2000) and the *Theory of Planned Behavior* (Ajzen, 1991), suggesting that sustainable actions are shaped by an interplay of beliefs, values, and emotional motivation. Practically, the scale can guide educators and policymakers in evaluating how effectively sustainability is being internalized by students and in designing interventions that foster long-term behavioral commitment rather than superficial awareness.

Comparing this study to previous research, it is evident that most prior instruments either addressed specific environmental behaviors or focused on adult or teacher populations (Afacan & Demirci Güler, 2011; Sağdıç & Şahin, 2015). Few studies have targeted middle school students, despite this period being crucial for value and identity formation. The ASTSD therefore fills an important gap by providing a psychometrically valid and theoretically grounded tool for this developmental stage. Moreover, by integrating affective and behavioral elements, it moves beyond the cognitive emphasis of traditional environmental education instruments, offering a more holistic picture of sustainability-oriented attitudes.

In conclusion, the ASTSD offers a comprehensive and innovative contribution to sustainability education research. It not only provides an empirically validated measurement tool but also presents a theoretical synthesis connecting the psychological underpinnings of attitude with the systemic dimensions of sustainable development. Future studies may use this scale to explore cross-cultural differences, longitudinal changes in sustainability attitudes, or the impact of specific curricular interventions. Through such applications, the ASTSD has the potential to advance both the theory and practice of sustainability education by promoting the development of informed, empathetic, and action-oriented global citizens.

Implications

In this study, the Attitude Scale towards Sustainable Development was developed to determine middle school students' attitudes toward sustainable development based on cognitive, affective, and behavioral dimensions. The developed scale is suitable for contributing to research focused on measuring students' attitudes toward sustainable development at the middle school level. Furthermore, it provides a functional tool for researchers aiming to examine students' attitudes about various variables. This scale enables researchers to investigate the effects of various course contents on students' attitudes toward sustainable development, as well as to examine the relationships between sustainable development attitudes and other attitudinal constructs.

Statement of Responsibility

All authors have made equal contributions throughout all phases of the article. They have each reviewed and approved the final version of the manuscript. This article originates from the doctoral dissertation of the first author, conducted under the guidance of the second and third authors.

Conflicts of Interest

The authors state that no conflicts of interest exist concerning any institution or individual associated with this study.

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