

The development of the Sustainable Consumption Behavior and Intention Scale

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Abstract: The aim of this study is to develop a measurement tool entitled the Sustainable Consumption Behavior and Intention Scale (SuCBIS) that provides valid and reliable data for identifying individuals' sustainable consumption behaviors and their intentions within the framework of zero waste regulation. The scale was constructed based on the steps of the zero-waste hierarchy: reconsider, reuse, recycle, and rot (compost). The research was designed within the scope of a descriptive survey model based on scale development. For the validation and reliability processes of the scale, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were employed. Convenience sampling was used in the study. The EFA was conducted with 242 pre-service teachers, while the CFA was carried out with a different sample of 280 pre-service teachers. The participants were undergraduate students enrolled in various teacher education programs. Content validity was ensured through literature review, the opinions of pre-service teachers, and expert evaluations. As a result of EFA, a five-factor structure was revealed regarding consumption behavior: reconsider, reuse, reduce, recycle, and compost. CFA findings indicated that the developed model showed an acceptable level of model-data fit. The reliability of the data obtained from the scale was supported by internal consistency analyses and item-total correlations. In conclusion, a measurement tool that provides valid and reliable data for evaluating pre-service teachers' sustainable consumption behaviors and intentions has been developed.

1. INTRODUCTION

Reducing waste on Earth is among the important issues for the future and the sustainability of the world. Zero waste is defined as a waste management process and approach that includes preventing waste in the evaluation of waste, using resources more efficiently, preventing or minimizing waste generation, and separating and recycling waste at its source if it occurs (Zero Waste Regulation, 2019: Article 4). Zero waste is closely related to issues such as limited natural resources and pollution. It is an approach that aims to protect the environment and human health and all resources by preventing/reducing waste generation in production, consumption and service processes, prioritizing reuse, collecting the generated waste separately at the source, and reducing the amount of waste to be sent for disposal by ensuring recycling

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and/or recovery (Bektaş, 2020). The reason for adopting the zero-waste approach in many countries is that it encourages sustainable production and consumption, sustainable development, recycling and resource transformation (Zaman, 2015).

Along with the zero-waste goal, environmentally friendly consumption habits also support sustainability and waste reduction efforts. Environmentally friendly consumption includes the understanding of choosing nature-friendly products and using resources efficiently in order to reduce environmental impacts. Environmentally friendly products can be products made from renewable and recyclable materials or those that consume low energy. In addition, extending the life of products, encouraging reuse and using recycling systems effectively are examples of environmentally friendly consumption. According to the zero-waste regulation, the most priority option according to the waste hierarchy is considered as prevention and reduction, as shown in Figure 1. The last option is disposal, and in this process, energy recovery is stated as the last method that should be preferred according to the waste management hierarchy (Bektaş, 2020).

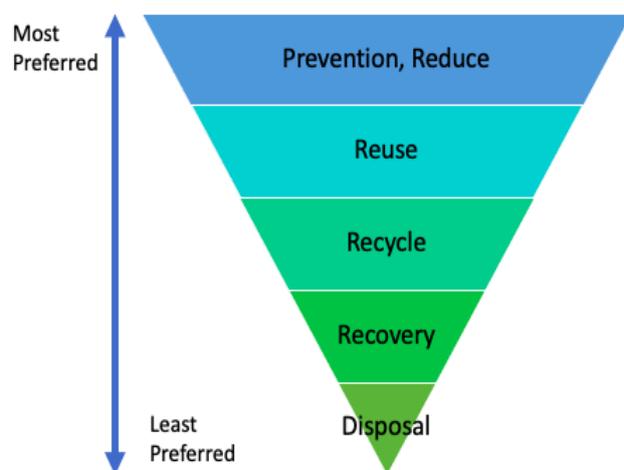


Figure 1. Methods of dealing with waste according to waste hierarchy (Bektaş, 2020).

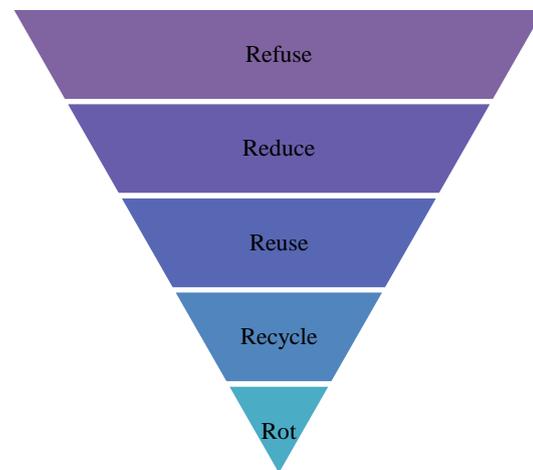


Figure 2. Zero waste process with 5R code of conduct (Johnson, 2019, p.13).

Johnson (2019) visualized the approach in the zero-waste process in Figure 2. In Figure 1 and Figure 2, reduction, reuse and recycling are seen among the commonalities in waste reduction methods. The zero-waste approach includes the 3R rule of "Reduction, Reuse and Recycle", which forms the basis of environmental awareness (Song *et al.*, 2015). When composting is associated with disposal, the only difference between the two images may be the extent of energy recovery.

In order to achieve the zero waste goal, "Refuse", derived from the English word starting with the letter R, means thinking carefully before purchasing and rejecting if it is not really needed; "Reduce", living more simply and reducing what you do not need; "Reuse" to use for different purposes or to use repeatedly; "Recycle" means, first of all, calculating that you will recycle when buying things that you cannot reject, reduce or reuse; The fifth and last dimension is considered as "Rot" (Johnson, 2019).

If people change their consumption behavior and adopt a lifestyle in accordance with the 5R behavior, waste production can be minimized or approach zero. Adopting this approach, Johnson (2019) explained it with examples from his life in his book *Zero Waste Home*. She explains many of the methods she has implemented in her life, such as cloth bags, jars and storage containers with lids, shopping for food without packaging, bartering and sewing. There are also versions derived from the letters "R" that use many words such as renewal, reduction, redesign, transformation, repair, rethinking, restoration, association, taking responsibility, rot.

In 2010, The World Organization for Early Childhood Education (OMEP) changed and developed the 7Rs at the international workshop titled "The Role of Early Childhood Education for a Sustainable Society". It is discussed as Reduce, Reuse, Respect, Reflect, Rethink, Recycle and Redistribute (Duncan, 2011). The new 7Rs are organized to include the three pillars of education for sustainable development, namely social and cultural development, economic development and environmental protection. The biggest purpose in choosing different words is to reduce waste. Many words derived from the letter "R" have been used, such as renewal, reduction, redesign, redefinition, repair, rethinking, restoration, relate, response, and rot. In short, the main purpose of choosing these words is to reduce waste.

With the cooperation established between the Ministry of Environment, Urbanization and Climate Change (CSB), Ministry of National Education (MEB) and Turkish Foundation for Combating Erosion, Afforestation and Protection of Natural Assets (TEMA) in 2018, the "Zero Waste Education Project" was launched in primary schools, and in the project, it was decided to teach zero waste to students with the "5D Rule". These are the principles created based on the principles of zero waste: *Think and Do not Consume Unless Necessary* (Düşün ve Gerekli Değilse Tüketme), *Consume Less* (Daha Az Tüket), *Evaluate and Reuse* (Değerlendir ve Yeniden Kullan), *Replace and Use for Different Purposes* (Değiştir ve Farklı Amaçla Kullan), *Recycle and Return to Nature* (Dönüştür ve Doğaya Geri Kazandır) (TEMA, 2018).

Scales related to consumption habits in the literature; Environmentally Friendly Product Consumption Behavior Scale (Karadağ Alçı *et al.*, 2023), Socially Responsible Consumption Behavior Scale (Terzi *et al.*, 2023), Recycling Awareness Scale (Ocak *et al.*, 2022), Hedonic and Utilitarian Consumption Behavior Scale (Coskun & Marangoz, 2019), Green Organizational Behavior Scale (Erbaşı, 2019), The Awareness Scale on The Recycling (Aksan & Çelikler, 2017), Conscious Consumer Scale (Buğday, 2015), Sustainable Consumption Behavior Scale (Doğan *et al.*, 2015), Environmental Responsibility Consumer Awareness Scale (Köse & Gül, 2014), Sustainable Environmental Education Attitude Scale (Afacan & Demirci-Güler, 2011). [Table 1](#) below lists the scales, dimensions and number of items in the literature.

Existing scales have focused on psychological, socio-cultural or economic factors affecting consumption behaviors and have been addressed with the dimensions of environmental consumption behaviors, sensitivity, recycling, green consumption, anxiety, awareness, belief and attitude (Aksan & Çelikler, 2017; Buğday, 2015; Doğan *et al.*, 2015; Erbaş, 2019; Karadağ Alçı *et al.*, 2023; Karatekin, 2013; Köse & Gül, 2014; Ocak *et al.*, 2022; Tekkaya *et al.*, 2011; Terzi *et al.*, 2023). When the scales mentioned above are examined, it is seen that the steps of reuse, rejection, waste reduction and reuse, which are among the dimensions of zero waste practices, are not included. In the literature review, there is no scale measuring behavior and intention adopting the zero-waste approach. Likewise, it is thought that these concepts included in the zero-waste regulation are not sufficiently included in the curriculum and textbooks. This study was prepared based on the lack of these topics. Achieving the zero-waste goal is important in terms of supporting economic development, reviewing our consumption behaviors and reducing environmental impact. Recycling is a costly, energy-consuming and difficult process, and waste plays a major role in changing consumption behaviors by creating a negative impact on the environment.

The sample of the study consists of prospective teachers, as awareness related to environmental behavior is formed at an early age, learning at this stage tends to be more permanent, and teachers are the key figures responsible for delivering education. Today's prospective teachers are tomorrow's educators. Those who adopt nature-based and conscious consumption practices can serve as role models for their students, both personally and professionally. Teachers who evaluate, transform, and reduce their own consumption habits-while acting in accordance with environmental protection principles-can inspire similar behaviors in their students.

Table 1. Names, dimensions and number of items of scales and questionnaires in the national literature.

Publication Date	Name of the Scale	Sub-Dimensions	Number of Items
2023	The Environmentally Sensitive Product Consumption Behavior Scale (Karadağ Alçı <i>et al.</i> , 2023)	Environmentally friendly purchasing intention Special Norm Attitude Environmental Concern	19
2023	The Socially Responsible Consumption Behavior Scale (Terzi <i>et al.</i> , 2023)	Unidimensional	10
2022	Recycling Awareness Scale (Ocak <i>et al.</i> , 2022).	Awareness Consciousness	20
2019	The Hedonic and Utilitarian Consumption Behavior Scale (Coskun & Marangoz, 2019)	Hedonic Effect Hedonic Adaptation Passive State Impulsive Tendency Identity Mirroring	42
2019	Green Organizational Behavior Scale (Erbaş, 2019)	Environmental Sensitivity, Environmental Participation, Economic Sensitivity, Green Purchasing, Technological Sensitivity	27
2017	The Awareness Scale on The Recycling (Aksan & Çelikler, 2017)	Environmental, Educational, Economic, Administrative, Legal, Susceptibility, Media, Protection of Natural Resources, Features of Recycled Products, Biological.	48
2015	Individuals' Sustainable Consumption Behavior (Doğan <i>et al.</i> , 2015),	Environment, Unneeded Consumption, Savings, Reusability.	17
2015	Conscious Consumer Scale (Buğday, 2015)	Environmentally Conscious Consumption, Ethical Consumption, Simple Consumption, Socially Responsible Consumption	25
2014	Consumption Consciousness Depending on Environmental Responsibility Scale (Köse & Gül, 2014)	Responsibility and awareness towards the environment Consumption and Purchasing Saving	25
2013	Attitudes Towards Solid Waste and Recycling (Karatekin, 2013)	Initiative and Participation Belief Interest and Sensitivity	33
2011	Attitude Scale Towards Solid Waste and Recycling Studies (Tekkaya <i>et al.</i> , 2011)	Attitude Behavior Beliefs The Importance of Behavior Consequences Subjective Norm Perceived Expectations The Importance of Expectations Perceived Behavior Control Perceived Conditions/Situations Facilitating Conditions/Situations Behavior Intention Recycling Behavior	102

Although the principles of zero waste have been adopted as public policy, they are not yet sufficiently integrated into school curricula. Therefore, it is essential to develop a measurement tool that reveals prospective teachers' behaviors and intentions related to sustainable consumption. The scale developed in this study focuses on the key steps of the zero-waste approach in order to evaluate prospective teachers' consumption habits and intentions. The sub-dimensions of the scale-namely waste reduction, critically examining the need for consumption, rejecting unnecessary items, reusing, recycling, and composting-are structured to offer a new perspective to the field. Moreover, the scale is designed to measure both behavior and intention, with the aim of illuminating possible discrepancies between the two and offering insights for future research.

Numerous theoretical models have been developed to understand individuals' attitudes and behaviors toward environmental issues. These models indicate that knowledge alone is insufficient to foster environmental behavior; instead, values, attitudes, social norms, perceived personal responsibility, and identity development all play critical roles (Ajzen, 1991; Gifford & Nilsson, 2014). The Theory of Planned Behavior emphasizes the cognitive structures underlying behavioral intentions, while Kollmuss and Agyeman (2002) highlight the "value-action gap," whereby knowledge and values do not necessarily lead to behavior. In this context, prospective teachers need a holistic educational approach that integrates cognitive, affective, and experiential learning in order to develop an environmentally responsible identity. Additionally, Steg and Vlek (2009) argue that contextual and structural factors, beyond individual motivation, significantly influence pro-environmental behavior. They emphasize that nature-based learning environments have transformative potential for the development of ecological identity. In line with these perspectives, this study aims to evaluate the consumption behaviors and intentions of prospective teachers using a zero-waste framework enriched through nature-based environmental education.

2. METHOD

In this section, the study participants, the "Sustainable Consumption Behavior and Intention Scale" development process and data analysis techniques are presented

2.1. Participants

Convenience sampling is a type of sampling in which the researcher applies a survey to the people he can most easily reach. It is related to the fact that it is easier to include the individuals or groups to be researched in the research process or to reach them (Yıldırım & Şimşek, 2008). The study was conducted within the Faculty of Education at a public university located in the city center of Denizli. In order for the scale to represent the target population, efforts were made to reach pre-service teachers enrolled in different teacher education programs, and data were collected from participants at various grade levels. In order to obtain valid and reliable results, it was aimed for the sample to represent the universe as accurately as possible. For this reason, data were collected in general culture courses where students from 2nd, 3rd and 4th grades could take courses. These courses were selected both because the number of students was high and because students from each department took these courses. While the data collected for the exploratory factor analysis were collected from teacher candidates who took the elective vocational knowledge course in the 2022-2023 fall semester ($n = 242$), it was collected in the 2022-2023 spring semester ($n = 280$) for the confirmatory factor analysis.

2.2. Scale Development Process

The basic stages in the process of creating an original scale show similar characteristics. These stages can be grouped under the name of examining the theoretical structure and creating items, consulting expert opinion, pilot application, main application, and validity and reliability analyses (DeVellis, 2014; Hinkin, 1998; Karasar, 2014; Seçer, 2015; Şeker & Gençdoğan, 2014). In this study, the steps in [Figure 3](#) were followed:

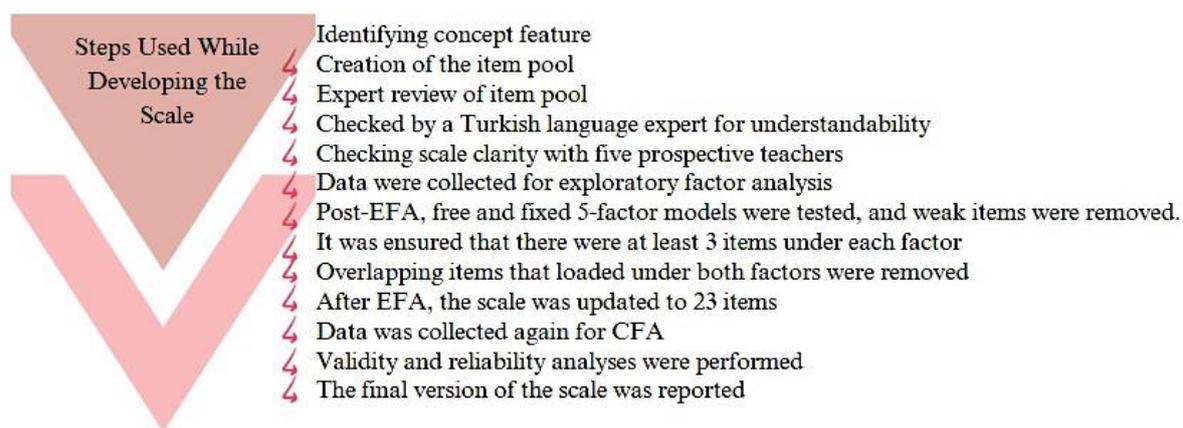


Figure 3. Steps followed while developing the scale.

While preparing the scale items, 3R, 5R, 7R and 5D, literature review, semi-structured interviews with teacher candidates and interviews with field experts were used. While scanning the literature, Reject, Reduce, Reuse, Recycle and Rot, which Johnson (2019) covers in the zero waste process stated in his book; Think, transform, change, consume less and evaluate (TEMA, 2018) and 5D for the sustainability of nature: "Think, Do Not Consume Unless Necessary", "Consume Less", "Evaluate, Reuse", "Change, Different" The steps "Use for Purpose" and "Transform, Let Nature Win" (TEMA, 2019) are the concepts taken into consideration when creating the sub-dimensions of the scale. While preparing the consumption behaviors scale, 59 items were included in light of the classifications specified. 10-12 items were written under each sub-dimension. In order to avoid any misinterpretation in the items, no reverse items were written.

The scale consists of two parts. In the first part, they were asked to rate how they behave in daily life (Column A), while in the second part, they were asked how they wanted to behave and their intentions (Column B). It was stated that they had to answer in both columns while filling out the scale. Each item was rated as Never (1), Rarely (2), Sometimes (3), Often (4) and Always (5). The data to be used for exploratory factor analysis were collected from 242 teacher candidates studying at Pamukkale University Faculty of Education in the 2022-2023 fall semester. After EFA, the analyses were carried out by both freeing the number of factors and fixing them to 5 dimensions. Considering the item difficulty index and factor loadings, items that loaded below .30 and items that loaded on more than one factor were removed. There are at least 3 items under each factor. Finally, the scale was organized into 5 factors and 23 items.

2.3. Expert Opinion Consultancy

While consulting an expert opinion in the study, the scale items were written under each sub-dimension according to the literature. It was collected from four Science Education field experts in forms consisting of suitable, slightly corrected, correctable, not suitable and suggestions for each item. Later, the items were discussed in an online meeting with three field experts and two more items were added to the item pool, creating the first version of the scale consisting of 59 items. In addition, for this version of the scale, the opinion of a Turkish teacher was consulted and edited in terms of language control.

2.4. Analysis of Data

Before proceeding with the analysis of the data obtained in the study, frequency analysis was used to check whether there were any incorrectly entered data, and when deemed necessary, the participants' scales were re-checked and edited. After the data set was edited and checked, the number of missing data values was checked. According to Güzeller (2016), if there are missing values in a data set, these values can be deleted or different assignment methods can be used. Since there were 0 to 8 missing data under each item and the missing data rate was less

than 5%, it was preferred to delete the missing values in this study. In addition, since Little's MCAR test result accepted the H_0 hypothesis, the missing data were deleted because the data loss was random and independent of other independent variables ($p = .138$).

In order to ensure the construct validity of the scale, preliminary analyses were conducted prior to factor analysis. One of the fundamental criteria in determining the suitability of the data for factor analysis is whether a sufficient sample size has been reached (Munro, 2005). In this context, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were applied to evaluate the adequacy of the data. First, the KMO value was calculated to assess whether the sample size and the correlations among variables were appropriate for factor analysis. According to both Field (2018) and Büyüköztürk (2002), a KMO value above 0.80 is considered meritorious, indicating that the sample is sufficient to uncover latent structures through factor analysis. The KMO statistic reflects the proportion of common variance among variables, which is essential for producing stable and interpretable factor solutions. In addition, Bartlett's Test of Sphericity was employed to test the null hypothesis that the correlation matrix is an identity matrix, implying no significant relationships among the variables. A statistically significant result ($p < .05$) indicates that there are adequate inter-item correlations to proceed with factor analysis (Büyüköztürk, 2002; Field, 2018). Although Bartlett's test does not directly assess validity, it provides important preliminary evidence regarding the appropriateness of factor analysis, thereby contributing to construct validation.

The statistically significant results obtained from both the KMO and Bartlett tests confirmed that the dataset was suitable for factor analysis and supported the structural validity of the developed scale. Multivariate normality assumption calculations were performed for both data sets. In the first data set where EFA was performed, 36 items were removed, and it was revealed that multivariate normality was not achieved ($p < .05$) for 23 items. Likewise, in the second data set where CFA was performed, it was determined that multivariate normality was not achieved ($p < .05$).

When selecting items from the item pool, items that did not provide sufficient value in any dimension were removed and the analyses were re-run. Items that gave the best eigenvalues under factor distribution with different combinations were selected. In this process, items that did not load significantly on the dimensions that were expected to load at the beginning of the scale were also removed. In addition, items with negative values were removed even though they were not written as reverse items. Items that could be included in the 5 determined dimensions were included in the scale, and thus the number of scale items was determined as 23. The 36 items were removed because their factor load values were overlapping and they were not included in any dimension.

As a result of the analysis, it was determined that the correlation coefficients between the factors varied between 0.153 and 0.389. Based on this information, it can be said that there is a weak level of relationship between the factors (Durmuş *et al.*, 2013; Kalaycı, 2014; Şencan, 2005). For this reason, Oblimin oblique rotation factor rotation, which assumes that there is a relationship between the factors in EFA, was adopted (Büyüköztürk, 2002b). Principal Axis Factoring was used in this study. It is used in scale development studies to discover latent factors and to reveal the explanatory power of these factors for data (Büyüköztürk, 2002b).

Within the scope of EFA, Principal Axis Factoring, Kaiser-Meyer-Olkin (KMO) test and Bartlett sphericity test, percentage of explained variance calculation and calculation of factor load values were used (DeVellis, 2014). To determine the number of factors, Horn (1965)'s parallel analysis method, line graph and eigenvalues were examined. The number of factors was freed at the beginning of the analysis. Since the factor was more than the theoretical framework and two items were found under the factors, the number of factors was fixed and continued. This was supported in the parallel analysis method.

In this study, assumptions were tested before the validity and reliability analyses of the scale development. For multivariate normality, *p-values* of both skewness and kurtosis statistics are expected to be greater than 0.05. Mardia coefficient was found to be significant when calculated with the help of Jamovi Version 2.4.14. EFA and CFA were performed with the same application. In order to determine the reliability of the factors, both Cronbach's alpha (α) and McDonald's omega (ω) coefficients were calculated (R Core Team, 2022; Revelle, 2023; Rosseel, 2023; The Jamovi Project, 2023). Cronbach's alpha is a widely used reliability measure, but it assumes tau-equivalence (i.e., that all items have equal factor loadings). In contrast, McDonald's omega offers a more robust estimate of internal consistency, particularly when item loadings vary across the scale (Dunn *et al.*, 2014). Table 2 below presents the Cronbach's alpha (α) and McDonald's omega (ω) reliability coefficients calculated for both the EFA and CFA samples, demonstrating the internal consistency of the Sustainable Consumption Behavior and Intention Scales. In this study, confirmatory factor analysis (CFA) was conducted, and the Diagonally Weighted Least Squares (DWLS) estimation method was used. The DWLS method is preferred when working with categorical (ordinal) data as it provides more reliable parameter estimates (Li, 2016). It is a specific type of Weighted Least Squares (WLS) estimation that utilizes only the diagonal elements of the covariance matrix. This method is known for its robustness against violations of normality assumptions.

Table 2. Consumption habits behavior and intention scale reliability value.

	Type of Scale	<i>n</i>	α	ω
EFA	Consumption Behavior Scale	242	.870	.872
	Consumption Intention Scale		.910	.925
CFA	Consumption Behavior Scale	280	.846	.850
	Consumption Intention Scale		.907	.911

Note. Diagonally Weighted Least Squares (DWLS) estimation method was used.

3. RESULTS

This section contains findings regarding the validity and reliability studies of the scale.

3.1. Findings Regarding Validity

The suitability of the data set obtained from 242 participants for exploratory factor analysis (EFA) was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO value was found to be .826, indicating that the sample size and inter-item correlations were sufficient for conducting factor analysis. According to established benchmarks, KMO values between .80 and .89 are interpreted as "great" in terms of sampling adequacy (Field, 2018). Moreover, as the KMO coefficient approaches 1, it reflects a stronger degree of shared variance among variables, with 1.00 representing perfect adequacy (Field, 2018). Bartlett's Test of Sphericity yielded a statistically significant result, $\chi^2(253) = 1801$, $p < .001$, indicating that the correlation matrix is not an identity matrix and that correlations among items were sufficiently large to justify factor analysis (Büyüköztürk, 2002; Tabachnick & Fidell, 2007). These findings collectively support the suitability of the data for factor analysis and strengthen the construct validity of the scale.

In the parallel analysis method used to discover how many dimensions the scale has it was seen that the number of factors was 5. In the line chart in Figure 4, it can be seen that the fifth factor is where the data and suggested lines intersect. The five-factor structure of the scale is shown in Table 3, considering its eigenvalue within the framework of the literature and theory, as its eigenvalue is above 1. To determine the number of factors, both statistical outputs and theoretical underpinnings were considered. Initially, the scree plot and eigenvalue criteria (greater than 1) suggested a five-factor solution. This decision was further supported by the theoretical framework of sustainable consumption behavior and intention, which is grounded

in Ajzen's (1991) Theory of Planned Behavior and extended by Kollmuss and Agyeman's (2002) model of pro-environmental behavior.

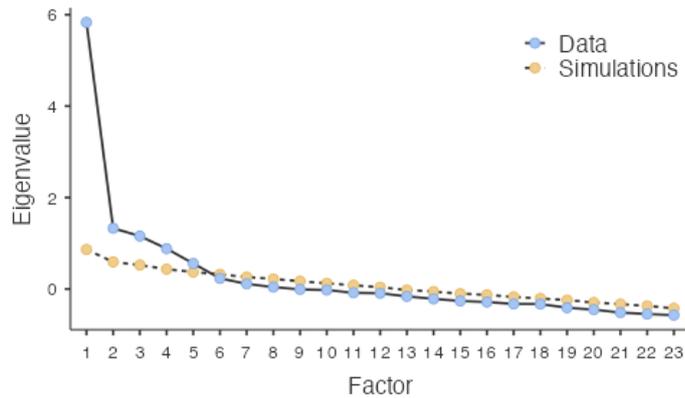


Figure 4. Parallel analysis line graph.

The five-factor structure aligns with the multidimensional nature of sustainable consumption, encompassing components such as awareness, intention, behavior, responsibility, and ethical concern, as suggested in previous literature (Gifford & Nilsson, 2014; Steg & Vlek, 2009). Thus, the factor structure reflects not only empirical findings but also established theoretical constructs in the field. Table 3 also includes the percentages of variance explained as a result of the analysis.

Table 3. EFA results.

Factor	SS Loadings	% of Variance	Cumulative %
1	2.64	11.48	11.5
2	2.33	10.13	21.6
3	2.28	9.90	31.5
4	1.79	7.80	39.3
5	1.79	7.76	47.1

When Table 3 above is examined, it can be seen that the number of factors is compatible with 5. In the light of the theoretical structure, parallel analysis method and eigenvalues, the suitability of the 5-factor structure was decided. In addition, in the percentage of variance explained by EFA, 47.1% of the total variance was explained and is shown in the table.

The factor loading values and originality of the version of the scale consisting of 23 items are shown in Appendix A. The dimensions of the scale were labeled as Reconsider, Reduce, Reuse, Recycle, and Rot based on the related literature. The factor loading values of the scale items are also presented in Appendix A. When it is examined, it is seen that the factor loadings of the scale items range between .358 and .814. Since all values are greater than the critical cut-off points of .30, the items were retained in the scale (Büyüköztürk, 2002; Tabachnick & Fidell, 2007), the items can be included under the factor structure. In EFA, it is desirable that the items have a high relationship with the factors, and it can be said that the scale shows a distribution consistent with the characteristics to be measured.

CFA was conducted to verify the 5 factor and 23 item structure determined in EFA on the second data set of 280 people in the study and to reveal the causality relationship between the determined items. Modification suggestions were also evaluated from the analysis results. Modifications were made between items 4 and 14, 9 and 23, 5 and 10, 15 and 18. It was thought that the error variances might be related because the items in question were of the same size and the statements were similar to each other and expressed the same behavioral tendency. It was determined that there was an improvement in the fit indices with the modification made.

As a result of CFA, it was determined that all items explained the main variance at a statistically significant level ($p < .001$).

In this study, confirmatory factor analysis (CFA) was conducted, and the Diagonally Weighted Least Squares (DWLS) estimation method was used. The DWLS method is preferred when working with categorical (ordinal) data as it provides more reliable parameter estimates (Li, 2016). It is a specific type of Weighted Least Squares (WLS) estimation that utilizes only the diagonal elements of the covariance matrix. This method is known for its robustness against violations of normality assumptions.

When looking at the other fit indices in Table 4, it is noteworthy that all values except for the NFI value show an acceptable or good fit. It is generally recommended in the literature to evaluate model fit using multiple indices rather than relying on a single one, as each index provides different information about model performance (Cabrera-Nguyen, 2010; Schermelleh-Engel *et al.*, 2003). The RMSEA value was .050, with a 95% confidence interval of [.043, .065], indicating an acceptable model fit (MacCallum *et al.*, 1996). Based on these fit indices, it can be concluded that the model exhibits a good fit to the data and adequately reflects the underlying construct. In other words, the CFA results confirm the proposed structure of the Sustainable Consumption Behavior and Intention Scale (SuCBIS), consisting of 23 items and 5 factors.

Table 4. CFA fit indices and values.

Fit Index	Analysis Value	Shown Fit
χ^2 / df	365 / 216 = 1.68	Good Fit
RMSEA	.050	Good Fit
SRMR	.067	Acceptable Fit
CFI	.979	Good Fit
NFI	.951	Good Fit
NNFI	.976	Good Fit

The confirmatory factor analysis (CFA) results indicated that all factor loadings were statistically significant ($p < .001$), with standardized estimates ranging from .455 to .900. Standard errors were within acceptable ranges, and all z-values exceeded the critical threshold for statistical significance. These findings confirm the adequacy of the measurement model and demonstrate that the items reliably reflect their respective latent constructs. The path diagram derived from the CFA is presented in Figure 5.

In order to evaluate the reliability of the scale, both Cronbach's alpha and McDonald's omega coefficients were calculated. Although Cronbach's alpha is widely used in the social sciences, it relies on certain assumptions such as equal item means which are often violated in practice. When these assumptions are not met, alpha may underestimate the actual reliability of the instrument. Therefore, McDonald's omega was also computed in this study, as it provides a more accurate estimate of internal consistency by taking into account the factor loadings across items. The reliability coefficients for the scale dimensions based on the 5R framework are presented in Table 5. For the dimensions of Rot, Recycle, Reuse, and Reduce, both Cronbach's alpha and McDonald's omega values exceeded the recommended threshold of .70, indicating satisfactory internal consistency. However, for the Reconsider dimension, the reliability scores were relatively low ($\alpha = .616$, $\omega = .560$), suggesting potential issues with the construct consistency of this dimension. Although the Reconsider dimension demonstrated a reliability coefficient of $\alpha = .616$, which is considered acceptable according to some criteria (e.g., Nunnally & Bernstein, 1994), this value still falls below the commonly preferred threshold of .70. Therefore, these findings suggest that the items within the Reconsider factor may benefit from further revision or refinement to improve internal consistency and better represent the underlying construct.

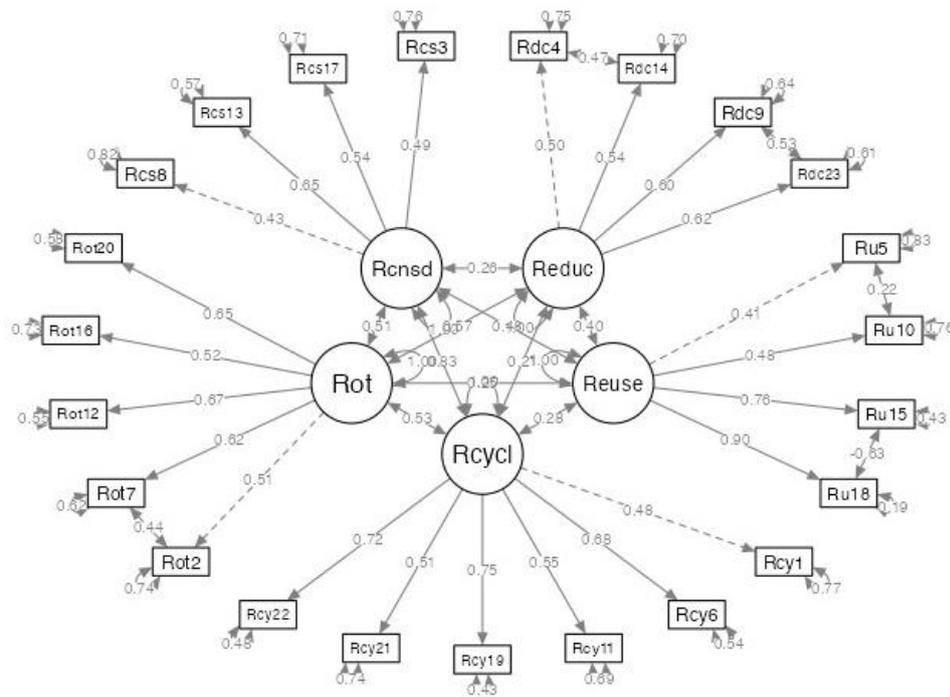


Figure 5. Path diagram of the model.

Table 5. Reliability coefficients of scale dimensions.

Dimensions	α	ω
Rot	.811	.773
Recycle	.808	.782
Reuse	.746	.713
Reconsider	.616	.560
Reduce	.803	.714

4. DISCUSSION and CONCLUSION

In this study, the Sustainable Consumption Behavior and Intention Scale (SuCBIS) was developed to assess both behavioral and intentional dimensions of sustainable consumption among prospective teachers. Since no existing scale in the literature evaluates these two constructs simultaneously, SuCBIS stands out as an original and significant contribution. The validity and reliability analyses confirmed that the scale demonstrates high internal consistency both at the total and subscale levels, supporting its potential for use in future applications.

However, the findings should be interpreted in light of certain limitations. Although the five-factor structure of the scale was supported by first-order confirmatory factor analysis (CFA), a second-order CFA or bifactor model was not conducted to determine whether a meaningful total score could be calculated. This constitutes a methodological limitation. Future research should consider testing second-order or bifactor models to provide more robust evidence regarding the unidimensionality of the scale. Until such evidence is available, it is recommended that subscale scores be reported individually rather than relying solely on a total score.

The variance explained by the scale was 47%, which falls within the generally accepted range of 40%–60% for similar instruments (Atabek-Yiğit *et al.*, 2020; Gökçe *et al.*, 2024). However, to enhance the explanatory power of the scale, future studies may revise existing items or develop new ones with larger and more diverse samples. The relatively modest variance explained may be attributed to the multifaceted nature of sustainable consumption behavior,

which encompasses cognitive, affective, social, and contextual dimensions. Similar to findings in prior research, it is not uncommon for scales measuring complex behaviors such as pro-environmental or sustainable actions to report explained variance below 50% (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). Additionally, since the current study was conducted exclusively with prospective teachers, its generalizability to other professional or demographic groups is limited. Testing the scale across various populations would expand its applicability and relevance.

This scale measures not only what individuals intend to do but also what they actually do, making it possible to examine the alignment or mismatch between intention and behavior. In complex constructs such as sustainable consumption which include cognitive, affective, and behavioral dimensions, identifying discrepancies between intention and behavior is critical for informing educational interventions. In this study, the grouping of "Reuse" and "Reconsider" items under the "Recycle" factor and the removal of several items from the behavioral dimension due to low factor loadings may indicate conceptual limitations in participants' understanding of zero-waste principles.

This finding is consistent with previous literature. Harman and Yenikalaycı (2019) found that pre-service teachers had limited awareness of the zero-waste approach, often interpreting it primarily through the lens of waste management and recycling, with minimal reference to reuse. Similarly, national studies tend to focus more on recycling rather than the broader zero-waste framework (Bulut & Çavuldur, 2017; Mutlu, 2013; Ural-Keleş & Keleş, 2018). This result is also in line with recent international literature emphasizing the need to address the gap between sustainability-related intentions and actual behaviors (Fischer *et al.*, 2017). For instance, Liu *et al.* (2012) found that even among individuals with positive attitudes toward green consumption, behavioral change often remained limited without adequate educational intervention. These findings underline the global relevance of the SuCBIS, which not only assesses both behavioral and intentional dimensions but also offers a structured tool for identifying educational needs in sustainable consumption practices across various contexts. Thus, SuCBIS serves as an important tool for reminding educators and learners that zero waste involves more than recycling, emphasizing the importance of reducing consumption, reusing materials, and rethinking habits.

These findings also support theoretical frameworks that distinguish between behavioral intention and actual behavior. According to Ajzen's (1991) Theory of Planned Behavior, behavioral intentions are shaped by attitudes, subjective norms, and perceived behavioral control, but do not always translate into action—a phenomenon also described as the "intention-behavior gap" by Kollmuss and Agyeman (2002). In this sense, SuCBIS not only captures this gap but also contributes a behaviorally grounded, context-specific measurement tool for sustainability education. Furthermore, the integration of zero-waste principles—such as reject, reduce, and compost—into the subdimensions of the scale expands the field beyond abstract environmental attitudes and toward actionable, measurable change. In addition, by highlighting the divergence between "Reconsider" and "Reuse," this study contributes to the growing body of research on ecological identity formation, which emphasizes experiential and values-based learning for sustainable behavior (Clayton, 2003; Steg & Vlek, 2009).

SuCBIS enables the evaluation of individuals' tendencies toward sustainable consumption at both behavioral and intentional levels and allows for the identification of intention-behavior discrepancies, which can inform both educational strategies and policy design. It is critical that sustainability education moves beyond recycling and incorporates a more holistic approach grounded in the principles of reducing, reusing, and rethinking. The developed scale can be employed as an assessment tool in teacher training programs, environmental education practices, and school-based sustainability initiatives.

While the present study provides valuable insights into sustainable consumption behavior and intentions through the development of the SuCBIS, several limitations should be

acknowledged. First, although the five-factor structure of the scale was supported by first-order confirmatory factor analysis (CFA), no second-order or bifactor model was conducted to assess the viability of a meaningful total score. Therefore, it is recommended that subscale scores be interpreted separately, and future studies should explore higher-order models to further validate the structure. Second, the sample consisted exclusively of prospective teachers from specific departments in a single region of Türkiye. This limits the generalizability of the findings to other populations, educational systems, or cultural contexts. Third, the study relied on self-reported data, which may be affected by social desirability bias or inaccurate self-assessment. Additionally, although the internal consistency of the scale was high, longitudinal data were not collected; thus, test–retest reliability and temporal stability remain unexamined. Finally, the cross-sectional design restricts the ability to observe changes in sustainable consumption behavior and intentions over time. These limitations may, in part, reflect the multifaceted and complex nature of sustainable consumption, which is influenced by a broad range of psychological, contextual, and socio-cultural factors (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). Future research should aim to address these limitations by employing longitudinal and cross-cultural designs with more diverse samples to enhance the scale’s robustness and applicability in broader educational and societal contexts.

In conclusion, SuCBIS enables the evaluation of individuals’ tendencies toward sustainable consumption at both behavioral and intentional levels and allows for the identification of intention–behavior discrepancies, which can inform both educational strategies and policy design. It is critical that sustainability education moves beyond recycling and incorporates a more holistic approach grounded in the principles of reducing, reusing, and rethinking. The developed scale can be employed as an assessment tool in teacher training programs, environmental education practices, and school-based sustainability initiatives. Moreover, its use can support policymakers and curriculum developers by providing data-driven insights into the effectiveness of sustainability education and guiding the design of interventions that promote long-term behavior change. Practically, the scale offers a framework for educators to diagnose and improve prospective teachers’ readiness to foster sustainable habits in their future classrooms. It can be used to tailor professional development programs, integrate sustainability more explicitly into teacher education curricula, and evaluate the impact of pedagogical strategies aimed at promoting eco-responsible behavior. Thus, SuCBIS not only contributes theoretically but also responds to practical educational needs in the field of environmental and sustainability education.

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Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number:** Pamukkale University Ethics Committee, 68282350/2022/G02.

Contribution of Authors

Merve Eker Çelebi: Conceptualization, Data collection, Analysis, and Drafting the manuscript. **Fatma Taşkın Ekici:** Supervision, Methodological support, and Critical revision of the manuscript.

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APPENDIX

Appendix A presents the factor loading values obtained from the exploratory factor analysis (EFA) conducted using the principal axis factoring method. As shown in the table, the items loaded clearly onto their respective factors, supporting the factorial validity of the scale. These results are consistent with the findings reported in the main text (see Section 3.1).

Appendix A. EFA factor loading values according to principal axis factoring - Turkish version.

Item	Sub-Dimensions					Uniqueness
	Rot (Kompost Yap)	Recycle (Geri Dönüştür)	Reuse (Yeniden Kullan)	Reconsider (Düşün)	Reduce (Azalt)	
7. Gıda atıklarımı kompost yaparak zengin içerikli toprağa/gübreye dönüştürebilirim.	0.814					0.296
12. Farklı kompost türleri yaşantımda kullanırım.	0.649					0.417
16. Kompost türlerine göre atıklarımı ayrıştırabilirim.	0.629					0.506
20. Organik atıklarımın soğuk/sıcak kompost yapabilirim.	0.601					0.520
2. Organik (doğada çözünebilir) atıklarımı çürütebilirim.	0.542					0.635
19. Satın aldığım ürünlerin geri dönüştürülebilir olmasına dikkat ederim.		0.707				0.479
1. Geri dönüşüm sürecinin maliyetli bir süreç olduğu için daha az atık oluşturan ürünleri satın alırım.		0.662				0.588
6. Alışveriş yaparken çevreye duyarlı (doğa dostu, geri dönüştürülebilir, hayvan haklarına saygılı vb.) ürünler satın alırım.		0.592				0.537
21. Yaşadığım şehirdeki geri dönüşüm tesisine atıklarımı gönderebilirim.		0.489				0.558
22. Geri dönüşüm sürecinde çok fazla enerji harcadığı için ambalaj atığı olmayan ürünleri tercih ederim.		0.383				0.607
11. Geri dönüşüm ürünlerini satın alırım.		0.358				0.725
15. Eskiyen/yıpranan ürünleri farklı amaçlarla kullanabilirim.			0.796			0.307
18. Yıpranan ürünleri tekrar kullanmanın yolunu bulabilirim.			0.747			0.385
5. Kırılan veya bozulan ürünleri tamir edip tekrar kullanırım.			0.730			0.452
10. Eskimiş yıpranmış kıyafetlerimi onarıp tekrar kullanırım.			0.475			0.671
13. Atıklarım doğaya olan etkisini üzerinde düşünürüm.				0.691		0.424
17. Gündelik tüketim alışkanlıklarımızı gözden geçiririm.				0.542		0.601
3. Tüketim tercihlerimin etkisinin farkında olarak davranırım.				0.534		0.659
8. Tükettiğimiz her şeyin üretim yolculuğunu hakkında bilgi sahibiyim.				0.384		0.638
9. Takas yaparak ihtiyaçlarımı karşılarım.					0.783	0.354
23. Takas tekniğiyle ihtiyaçlarımı gideririm.					0.730	0.438
14. İkinci el pazarlarından alışveriş yaparım.					0.486	0.641
4. İkinci el eşya satın alırım.					0.438	0.738

Note. 'Principal axis factoring' extraction method was used in combination with a 'oblimin' rotation.