# DEVELOPMENT AND VALIDATION OF ATTITUDES TOWARDS SUSTAINABLE DEVELOPMENT SCALE BY NIGERIAN UNIVERSITY STUDENTS

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## Introduction

Education is one of the key elements of human asset. It is also one of the principal sources of increased economic growth, development and enhanced welfare of an individual and a household in the process of economic transformation. Education is a life-long process for the betterment of human well-being. There is a growing interest in quantitative research that measures competences, attitudes and beliefs in Education for Sustainable Development, and researchers have considered several issues that are involved in the construction of these assessment tools (Schneller, Johnson, and Bogner, 2015). Education was considered to be a core discipline for disseminating sustainable development principles, and increased attention was dedicated to Education for Sustainable Development (ESD) (Cotton, 2007).

Education for Sustainable Development refers to educational programs and experiences that are designed to allow people to acquire the knowledge, skills and values that are necessary to shape a sustainable future. Chapter 36 of Agenda 21 (UNESCO 1992) was one of the first calls for action on education for sustainability and provided a basis for developing international networks on ESD that address the following three purposes: re-orienting education toward Sustainable Development (SD), increasing public awareness and promoting training. Several other initiatives were implemented by UNESCO, such as the United Nations' decade of education for Sustainable Development (UNESCO, 2005), to internationally support and improve the integration of ESD into educational strategies and educational action plans in all of the member countries. The UNESCO definition reads:

> Education for Sustainable Development means including key sustainable development issues into teaching and

> learning; for example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and take action for sustainable development. Education for Sustainable Development consequently promotes competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way (p. 14).

Within this definition we can see traces of two essential features of ESD: the first deals with content, the second with pedagogy. These two are well recognized in the literature: "ESD continues to grow both in content and pedagogy and its visibility and respect have grown in parallel" (p. 2). As seen in the UNESCO definition, ESD contents cover diverse disciplines: climate change, poverty reduction, consumption *etc*.

Education is the key to any sustainable development programme. Education should be recogonised as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address the environment and development issues (UNESCO, 1992). The purposes included the following (UNESCO, 2014):

- Incorporating quantitative and qualitative ESD indicators into the on-going monitoring and evaluation of education for all.
- Evaluating the achievement of measurable results in pursuing the aims and objectives, particularly with regard to the integration of ESD into national educational policies, programs and systems.
- Making recommendations to further promote ESD based on the results and lessons that are learned from the decade.

Scoullos (2013 p. 110) outlined the following characteristics of Education for Sustainable Development :

- Interdisciplinary and holistic.
- Learner-centred and participatory.
- Values-driven, promoting critical thinking and exploring all interested 'sides'.

- Forward-looking, promoting medium and long-term planning.
- Locally relevant, encouraging multilateral collaborations among schools, local actors and authorities, scientific communities, the private sector and NGOs, etc., and,
- Revealing global issues and connections as part of everyday life, whether in a small village or a large city.

These teaching/learning methods promote changes in behaviour and ways of thinking and relate not only to knowledge but also to processes, because these methods teach learners how to think – not what to think (Biasutti, 2015). These purposes demonstrate that there is a need for tools and measures to assess Education for Sustainable Development. The current study presents a quantitative tool that could be used for assessing the effects of curricula revision after having infused Sustainable Development principles. Moreover, the focus is on the development and validation of this scale, which measures SD attitudes in Nigerian University Students. In addition, the scale was applied to detect differences in SD attitudes among University Students pursuing different degrees courses. The purpose of the comparison was to demonstrate the utility of the scale.

However, studies reviewed lack another important dimension – education – that is transversal to these SD pillars. Education is a fundamental component of ESD and of the UNESCO mission and is a core aspect of Agenda 21 (UNESCO, 1992). The role of education is considered in many chapters of Agenda 21, with a specific focus in Chapter 36 (UNESCO, 1992; Section 36:3): education is considered crucial for supporting sustainable development and for advancing the ability of the people to address sustainable development issues. Education must be considered equally as it relates to the other components of SD and is essential for developing environmental and ethical awareness in mankind, including values and attitudes that are consistent with sustainable development. To produce effective improvement in the quality of knowledge and attitudes toward sustainability, constructivist learning theories and learner-centred methodologies should be considered (Biasutti, 2015). These theories should be based on innovative teaching methods, the promotion of future-oriented thinking and higher order thinking skills, interdisciplinary and the linking of local and global issues.

Regarding the SD tools, only a limited number of tools were developed, mainly concerning primary and secondary school students' knowledge, attitudes and behaviours (Olsson, Gericke, and Chang, 2015). These SD tools were based on the three dimensions – environment, economy and society – but they lack a focus on education, which is a crucial component

of Education for Sustainable Development. The current research aims to address these gaps by developing a quantitative scale that measures SD attitudes in university students, adding the new dimension 'education' to the three pillars of SD.

The purpose of this study is to develop and validate a quantitative scale for measuring Sustainable Development attitudes in Nigerian University Students. This scale is based on four dimensions – environment, economy, society and education.

The following research questions guided the study:

(1) Are the four dimensions of the tool confirmed by the exploratory and confirmatory factor analysis (CFA)?

(2) Does the tool meet the reliability (Cronbach's alpha) and stability criteria?

(3) Can the ASD scale detect difference in Sustainable Development attitudes among university students pursuing different degrees?

## Method

The study adopted a survey research design. The population of the study consisted of all the University students in Michael Okpara University of Agriculture Umudike. Five hundred and five students were enrolled to complete the questionnaire. Twenty-one of these questionnaires were not considered because some data were missing; the questionnaires used for the statistical analyses totaled 484 ($N = 128$ male, $N = 356$ female). The respondents were undergraduate students of the following degrees: agriculture engineering ($N = 67$) mechanical engineering ($N = 34$), biology education ($N = 30$), and biochemistry ($N = 353$). The data were collected over one month and were randomly separated into two subsamples: one subsample was assigned to the exploratory factor analysis group, and the other subsample was assigned to the Confirmatory Factor Analysis (CFA) group. A part of the original sample of 484 (97 participants) completed the questionnaire at two different times.

The questionnaire was validated by two measurement and evaluation experts and four lecturers in the departments involved. The experts were asked to check for ambiguous statements and to comment on the questionnaire about the conceptual validity and the formulation of the items. These comments

were considered when revising the scale, and all suggested changes were made to the items.

The validated questionnaire contains 20 items and is a self-reported scale used to measure students' attitudes toward Sustainable Development. A set of statements was presented, and respondents were asked to express their agreement on a five-point Likert scale with the following answer choices: 'strongly disagree', 'disagree', 'neutral', 'agree', and 'strongly agree'. A sample of the scale can be found in Appendix 1.

The data were analysed with SPSS Statistics 20 and Lisrel 8.80 to statistically test the validity and reliability of the scale. Exploratory factor analysis, descriptive statistics, Cronbach's alpha, and a CFA were computed. The stability of the scale was assessed by using multi-group invariance testing. In addition, a group comparison was performed with a t-test to compare the students who were pursuing degrees in agriculture engineering and biochemistry. These two groups were considered because they were the most representative – biochemistry had 353 respondents, agriculture engineering had 67 respondents, while mechanical engineering and biology education had only 34 and 30 respondents, respectively.

The first research question asked about the validity of the four-dimension model of ASD. The KMO and Bartlett tests were the first statistical analyses performed to verify suitability of the data for an exploratory factor analysis (Ugulu, 2015). A KMO value over .90 is optimal (Russell, 2002), and the values of the Bartlett test suggest that the null hypothesis must be rejected when there is a significance level of .05 (Snedecor and Cochran, 1989). The results included the following: KMO = .830; Bartlett test: $\chi^2 = 1338.83$, df = 190 ($p = .000$), which indicates that an additional factor analysis on the ASD can be conducted.

The second step was to perform an exploratory factor analysis that used a Varimax rotation method to determine the links between the observed variables and underlying factors (Byrne, 1998). The Kaiser criterion (Kaiser, 1960) and the Scree test were used to determine the number of factors, and the factors with eigenvalues equal or superior to one were considered. A structure of four factors, with five items for each factor, was found. A name for each factor was given, as follows:

(1) *Environment* (item 1–5; e.g. 'Environmental protection is more important than industrial growth' and 'Building development is less important than environmental protection').

(2) *Economy* (item 6–10; e.g. 'People should make more sacrifices in order to reduce the economic differences between populations' and 'Government economic policies should increase fair trade'). In spite of

item 9 loading slightly higher on factor 3 than on factor 2, it was grouped with factor 2 because it is about economy rather than education.

(3) *Society* (item 11–15; e.g. 'Society should provide free basic health services' and 'Society should take responsibility for the welfare of individuals and families'). In spite of item 13 loading slightly higher on factor 2 than on factor 4, it was grouped with factor 4 because it is about society rather than economy.

(4) *Education* (item 16–20; e.g. 'Lecturers in University should promote future-oriented thinking, in addition to historical knowledge' and 'Lecturers in University should promote critical thinking, rather than lecturing').

Table 1. Mean (*M*), standard deviation (SD), and rotated factor matrix (exploratory factor analysis) for the ASD.

| ASD items | M (SD) | Factors[a] 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1) When people interfere with the environment, they often produce disastrous consequences | 2.92 (.90) | .599 | | | |
| 2) Environmental protection and people's quality of life are directly linked | 4.06 (.95) | .604 | | | |
| 3) Biodiversity should be protected at the expense of industrial agricultural production | 3.32 (1.04) | .678 | | | |
| 4) Building development is less important than environmental protection | 3.82 (1.03) | .780 | | | |
| 5) Environmental protection is more important than industrial Growth | 3.66 (.94) | .752 | .329 | | |
| 6) Government economic policies should increase sustainable production even if it means spending more money | 3.80 (1.00) | .386 | .554 | | |
| 7) people should sacrifices more to reduce economic differences between populations | 3.77 (.98) | | .747 | | |
| 8) Government economic policies should increases fair trade | 3.85 (.91) | | .647 | | |
| 9) Government economic policies should act if a country is wasting its natural resources | 3.56 (1.03) | | .327 | .459 | |
| 10) Reducing poverty and hunger in the world is more important than increasing the economic well-being of the industrialized countries | 4.12 (.95) | | .538 | .350 | |
| 11) Each country can do a lot to keep the peace in the world | 4.08 (.96) | | | .543 | |
| 12) The society should further promote equal opportunities for males and females | 4.38 (.85) | | | .479 | |
| 13) The contact between cultures is stimulating and enriching | 4.37 (.88) | | .619 | .409 | |
| 14) The society should provide free basic health services | 4.52 (.78) | | | .710 | |
| 15) The society should take responsibility for the welfare of individuals and families | 4.16 (.87) | | | .651 | |
| 16) Lecturers in University should use student-centred teaching methods | 3.72 (.97) | | | .615 | |
| 17) Lecturers in University should promote future-oriented thinking in addition to historical knowledge | 4.10 (.88) | | | .704 | |
| 18) Lecturers in University should promote interdisciplinary between subjects | 4.31 (.76) | .341 | .589 | .371 | |
| 19) Lecturers in University should promote the connection between local and global issues | 4.12 (.82) | .396 | .531 | .304 | |
| 20) Lecturers in University should promote critical thinking rather than lecturing | 4.35 (.86) | | | .667 | |

[a]*Factors: 1 environment; 2 economy; 3 education; 4 society. (N = 216).*

The rotated factor values ranged between .327 and .780, as reported in Table 1. The rotation was unconstrained and items with factor loadings lower than .30 are not reported. In the factors where one item loaded in other factors, the higher value was considered, with the exceptions of items 13 and 9, as reported above. The factors explained 51.68% of the total variance, as indicated in Table 2. The results of the item loadings per factor, the eigenvalues and the variance that explains the percentages of the factors confirm the four factor structure. Descriptive statistics, eigenvalues, percentages of variance and Cronbach's alphas are reported in Table 2.

Table 2. Descriptive statistics mean (*M*) and standard deviation (SD), eigenvalue, percentage of variance, Cronbach's alpha (reliability).

| ASD factors | M (SD) N = 216] | Eigenvalu [N = 216] | %Variance [N = 216] | Cronbach's α [N = 484] |
|---|---|---|---|---|
| Environment | 3.56 [.70] | 5.342 | 14.734 | .743 |
| Economy | 3.82 [.67] | 2.582 | 13.376 | .737 |
| Education | 4.12 [.61] | 1.273 | 12.406 | .757 |
| Society | 4.30 [.56] | 1.139 | 11.167 | .660 |

The factor framework that was derived from the exploratory factor analysis was applied to the second study group of 268 participants so that the CFA could be performed by using the maximum likelihood method. In the CFA, all the adaptive values are reported because it is generally recommended to report more than one adaptive value (Thompson, 2000). The worth of the fit values is reported in Table 3. As the values suggest, there is an acceptable fit for RMSEA (values less than 0.5 indicate good fit), S-RMR, CFI, NNFI, and IFI, and there is a perfect fit for $\chi^2/d$ (Byrne, 1998; Schreiber, 2006). The CFA indicates that the four factors are confirmed, even if the GFI and AGFI are slightly lower than the middle values but close to the value 1, which is indicative of a good fit (Byrne, 1998).

The second research question asked about the reliability and stability of the scale. To determine the scale's reliability and internal consistency, the Cronbach's alpha reliability coefficient was calculated for each factor (values ranged between .660 and .757) and for the total score (.854). The Cronbach's alpha of .660 for the society factor was also accepted if it was low, because some reliability values lower than .70 were reported in other preliminary studies (Biasutti and Frezza, 2009; Liu, 2003), and also for factors with less than six items (Kyle, Graefe, and Manning, 2005). For these reasons, the Cronbach's alpha of value of .660 is considered acceptable for this research

(Ugulu, 2015). The results are shown in Table 3, which indicate that the scale has good internal consistency.

Table 3. Goodness of fit of CFA of ASD (*N* = 268) and multi-group invariance (MGI) configural and metric of pre- (*N* = 97) and post-test (*N* = 97) groups.

| Model | N | $\chi^{2(df)}$ | RMSEA | SRMR | GFI | AGFI | CFI | NNFI | IFI | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CFA | 268 | 238.82(164) | .041 | | .053 | .92 | .89 | .97 | .97 | .97 | |
| MGI configural | 97 | 418.23(328) | .054 | | | | .94 | .94 | .94 | | |
| Pre | 97 | | | | .086 | .83 | .79 | | | | |
| Post | 97 | | | | .091 | .81 | .76 | | | | |
| MGI metrical | 97 | 425.59(348) | .048 | | | | | .94 | 0.94 | .94 | |
| Pre | 97 | | | | .094 | .83 | .79 | | | | |
| Post | 97 | | | | .091 | .81 | .76 | | | | |

The stability of the scale was tested by using the multi-group invariance testing to compute the invariance between the two scale applications on a subsample of 97 participants, who responded to the scale. Data were computed using the multi-group configural and metric invariance testing. The multi-group configural test produced statistics indicative of a good fitting model, comparing the factor structure and factor-loading patterns (Powell, 2011). The measured invariance was tested, leaving the factor loadings free. The values shown in Table 3 suggest that RMSEA has a good fit, and the CFI, IFI and NNFI are acceptable (Byrne, 1998; Schreiber, 2006). Regarding the multi-group metric test, the relationships were verified between factors by constraining them to be equal across the two samples. The results of the analysis provided evidence that the structure of the ASD scale is the same in the two samples (RMSEA is a good fit, and the CFI, IFI and NNFI are acceptable). These findings confirmed the stability of the scale.

The third research question asked about the differences in SD attitudes among university students pursuing different degrees. A group comparison was performed with an independent sample t-test that compared the students who were pursuing degrees in agriculture engineering with those studying Biochemistry and that included Cohen's *d* as the effect size index. These two groups were selected because they were the most representative; for the other groups of students, there were only a few participants who could be used to perform a comparison (e.g. Biology education). Levene's test for testing the equality of variance was computed to determine when use an equal or unequal

means estimates of *t*. When the F was significant with $p < 0.05$ the unequal estimate of *t* was selected. The statistical analysis showed a significant difference between the ASD factors of environment, Levene's test ($F = 5.506$, $p = .019$) with $t(106.59) = –6.518$, $p < .001$, $d = 1.26$, Levene's test ($F = 4.763$, $p = .030$) and society, with $t(82,26) = 4.089$, $p < .001$, $d = .90$. Mean values for Biochemistry and Agriculture engineering students for the factor environment of the ASD were $M = 3.521$ SD = .673 and $M = 4.020$ SD = .554, respectively, and for the factor society, $M = 4.376$ SD = .502 and $M = 4.038$ SD = .637. Agriculture engineering students performed better on the environment factor than Biochemistry students, thus demonstrating stronger attitudes toward environmental care, whereas Biochemistry students performed better on the society factor, thus demonstrating more sensibility toward social issues.

## Discussion

The current research answers the call to create evaluation tools that assess Sustainable Development through the development and validation of a quantitative scale that measures SD attitudes in Nigerian university students. The results of the principal components factor analysis show that the scale consists of the following four dimensions: environment, economy, society and education, which are confirmed by the CFA and by the multi-group invariance testing. These findings provide evidence that the structure of the items lends support to the UNESCO framework of sustainability, which includes the environment, the economy and society (UNESCO 2005), plus education. The reliability and stability analyses show that the instrument meets the validity criteria quite well, and the ASD seems to be appropriate for measuring SD attitudes in university students in Nigeria.

The group comparison analysis provided an idea of the possible applications of the ASD in higher education by comparing agriculture engineering students and biochemistry students. The findings highlighted a different trend regarding the students' backgrounds: the agriculture engineering students performed better on the environmental factor than the biochemistry students, whereas the biochemistry students performed better on the society factor than the agriculture engineering students. These findings demonstrated that agriculture engineering students had a greater pro-environmental attitude, whereas biochemistry students were more oriented toward social issues.

This study fits into the existing literature on EE (Dijkstra and Goedhart, 2012; Schneller, Johnson, and Bogner, 2015) and ESD assessment (Biasutti and Surian, 2012; Michalos, 2012; Olsson, Gericke, and Chang

Rundgren, 2015). Previous instruments for EE are based on the beliefs about the relationship between the environment and humans, and the ESD tools focused on SD knowledge, attitudes and behaviours (Biasutti and Surian, 2012; Michalos, 2012; Olsson, Gericke, and Chang Rundgren, 2015). The ASD contributes to the current knowledge base and focuses on the UNESCO dimensions of sustainability, which include the environment, the economy and society. In addition, the ASD fills the gap in the educational dimension, because few previous tools considered education to be a main factor. The ASD education factor dedicates a special focus to the methodological issues by combining teaching approaches and the basic principles of how education could contribute to ESD.

**Conclusion**

The purpose of this research study was to demonstrate that there is a need for tools and measures to assess Education for Sustainable Development. This study developed a quantitative scale that measures SD attitudes in University students. The findings of this study provide evidence that the structure of the items lends support to the UNESCO framework of Sustainability. The instrument meets the validity criteria, quite well, and the ASD seems to be appropriate for measuring SD attitudes in University Students in Nigeria.

**Recommendations**

1. The attitudes towards sustainable development scale should be used to understand the ways in which students think about sustainability issues.
2. The scale should be used to investigate the relationship between sustainability attitudes and other variables.
3. Education for Sustainable Development should actively promote gender equality, as well as create conditions and strategies that enable women to share knowledge and experience of bringing about social change and human well-being.

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Appendix 1. **The Attitudes toward Sustainable Development scale**
Please indicate the extent of your agreement/disagreement with the statements by using the following scale:

| | SA | A | N | D | SD |
|---|---|---|---|---|---|
| 1) When people interfere with the environment, they often produce disastrous consequences | 5 | 4 | 3 | 2 | 1 |
| 2) Environmental protection and people's quality of life are directly linked | 5 | 4 | 3 | 2 | 1 |
| 3) Biodiversity should be protected at the expense of industrial agricultural production | 5 | 4 | 3 | 2 | 1 |
| 4) Building development is less important than environmental protection | 5 | 4 | 3 | 2 | 1 |
| 5) Environmental protection is more important than industrial growth | 5 | 4 | 3 | 2 | 1 |
| 6) Government economic policies should increase sustainable production even if it means spending more money | 5 | 4 | 3 | 2 | 1 |
| 7) People should sacrifice more to reduce economic differences between populations | 5 | 4 | 3 | 2 | 1 |
| 8) Government economic policies should increases fair trade | 5 | 4 | 3 | 2 | 1 |
| 9) Government economic policies should act if a country is wasting its natural resources | 5 | 4 | 3 | 2 | 1 |
| 10) Reducing poverty and hunger in the world is more important than increasing the economic well-being of the industrialized countries | 5 | 4 | 3 | 2 | 1 |
| 11) Each country can do a lot to keep the peace in the world | 5 | 4 | 3 | 2 | 1 |
| 12) The society should further promote equal opportunities for males and females | 5 | 4 | 3 | 2 | 1 |
| 13) The contact between cultures is stimulating and enriching | 5 | 4 | 3 | 2 | 1 |
| 14) The society should provide free basic health services | 5 | 4 | 3 | 2 | 1 |
| 15) The society should take responsibility for the welfare of individuals and families | 5 | 4 | 3 | 2 | 1 |
| 16) Lecturers in University should use student centred teaching methods | 5 | 4 | 3 | 2 | 1 |
| 17) Lecturers in University should promote future oriented thinking in addition to historical knowledge | 5 | 4 | 3 | 2 | 1 |
| 18) Lecturers in University should promote interdisciplinarity between subjects | 5 | 4 | 3 | 2 | 1 |
| 19) Lecturers in University should promote the connection between local and global issues | 5 | 4 | 3 | 2 | 1 |
| 20) Lecturers in University should promote critical thinking rather than lecturing | 5 | 4 | 3 | 2 | 1 |