

The Factor Structure of the Environmental Attitude Scale in a Community-Based Study in Lagos, Nigeria

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Abstract

Environmental Attitude (EA) has been understood to be a complex multidimensional construct with minimal empirical evidence in developing countries. In the present study, psychometric properties of an EA scale was empirically assessed using data from a community based study conducted in Nigeria. Different measures of EA were aggregated into a single EA scale and administered to 1,858 individuals. Mean (Standard deviation) and proportions were used to describe the distribution of continuous and discrete data respectively. Reliability of the scale was assessed using Cronbach alpha. Varying hypothetical models of the EA were assessed using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Data were analysed using IBM SPSS version 20 and AMOS version 21 at 5% significant level. Overall mean score and alpha coefficient for the combined EA measure was 381.7 (49.0) and 0.928 respectively. A 3-factor structure accounting for 36% cumulative variance in the scale item was extracted in an EFA. A non-orthogonal 3-factor model was a significant improvement over the original none-correlated 5-factor model [$\chi^2(1344)=29216.33$, $P<0.001$; CAIC=9816.870]. The conceptualization of the EA as a non-orthogonal 3-factor structure provides a better fit to the present data. The 3-factor structure is advised in Nigeria and similar settings.

La structure factorielle de l'échelle d'attitude environnementale dans une étude communautaire à Lagos, au Nigéria

Abstrait

L'attitude environnementale (AE) a été connue d'être construit multidimensionnel et complexe avec des preuves empiriques minimales dans les pays en voie de développement. Dans l'étude actuelle, les propriétés psychométriques d'une échelle d'évaluation environnementale ont été évaluées de manière empirique à l'aide de données provenant d'une étude menée au niveau communautaire au Nigeria. Différentes mesures d'évaluation environnementale ont été regroupées dans une seule échelle d'évaluation et administrées à 1 858 personnes. La moyenne (type écart) et les proportions ont été utilisées pour décrire la distribution des données continues et discrètes, respectivement. La fiabilité de l'échelle a été évaluée à l'aide du coefficient alpha de Cronbach. Différents modèles hypothétiques de l'AE ont été évalués à l'aide d'une analyse factorielle exploratoire (AFE) et d'une analyse factorielle confirmatoire (AFC). Les

données ont été analysées avec IBM SPSS version 20 et AMOS version 21 à un niveau significatif de 5%. Le score moyen global et le coefficient alpha de la mesure de l'EA combinée étaient respectivement de 381,7 (49,0) et 0,928. Une structure à 3 facteurs représentant une variance cumulée de 36% de l'élément d'échelle a été extraite dans un EFA. Un modèle à 3 facteurs non orthogonal constituait une amélioration significative par rapport au modèle original à 5 facteurs sans corrélation [$\chi^2(1344) = 29216,33, p < 0,001; CAIC = 9816.870$]. La conceptualisation de l'AE en tant que structure à 3 facteurs non orthogonale offre un meilleur ajustement aux données actuelles. La structure à 3 facteurs est conseillée au Nigeria et dans des contextes similaires.

Introduction

The environmental consequences of human behaviours and their implications on the global ecology including the built environment cannot be over emphasized. Many of the environmental challenges facing the world today are a direct result of human behaviour towards the use of environmental resources (Oskamp, 2000; Saunders, 2003; Hirsh, 2010; Larson, Stedman, Cooper & Decker, 2015; Young-Chang & Keun-Ho, 2015). In recognition of this fact, many researchers have investigated the social and psychological factors that influence environmental attitudes and behaviours. Environmental Attitude (EA) has been defined as a collection of beliefs, affect, and behavioural intentions a person holds regarding environmentally related activities or issues (Schultz, Shriver, Tabanico, & Khazian, 2004; Larson, *et. al*, 2015). Its dimensionality and structure has continued to generate serious discussion in the scientific community.

Apart from that, some earlier studies have also considered EA as a uni-dimensional construct. For instance, measured by the New Environmental Paradigm (NEP), EA was thought to be unconcerned about the environment and concerned at either end of the scale (Dunlap & Van Liere, 1978; Dunlap, Van Liere, Mertig, & Jones, 2000; Milfont & Duckitt, 2004). In recent time however, EA has been understood to be a complex multi-dimensional construct having concern for all living things (Ecocentric), concern for humans (Anthropocentric), concern for the self (Egoistic), concern for other people (Altruistic), and concern for the biosphere (Biospheric) (Schultz, 2001; Milfont and Duckitt, 2004). In an elaborate assessment of the factor

structure of the Environmental Attitude of psychology students from the University of Auckland, New Zealand, Milfont and Duckitt (2004) presented 10 dimensions (ranging from Enjoyment of nature to Necessity of development) for the EA. In addition, previous studies suggested that a high degree of internal consistency across items may imply that a set of such items can be combined into a single measure for the purpose of assessing a resultant construct (Lalonde & Jackson, 2002; Erdogan, 2009).

Though a paper had earlier studied the empirical effects of demographic characteristics of respondents on EA (Ogunjimi, Onadeko & Adewumi, 2012) in a sample of household heads in Nigeria, only the NEP scale was used in the study. Moreover, there has been no record of past study in Nigeria where the psychometric properties of measure related to EA were previously investigated. It is important to assess the structure of a measure prior to relevant use in settings where it has not been previously validated (Villacorta, Koestner & Lokes, 2003), otherwise; conclusions based on such application may be misleading.

In the present study, psychometric properties of a combination of five Environmental Attitude Scale (consisting of the New Ecological Paradigm (NEP) Scale (Dunlap, Van Liere, Mertig & Jones, 2000); Ecocentric (ECO) Scale (Thompson & Barton, 1994); Anthropocentric (ATR) Scale (Thompson & Barton, 1994); Motivation Toward the Environment (MTE) Scale (Pelletier et al, 1997, 1998); and Connectedness to Nature (CNS) Scale (Mayer & Frantz, 2004) were investigated using data from a community based study conducted in Lagos, Nigeria. Aggregating

the various measures into a single EA scale, we further assessed how the items on the scale loaded on their intended subscales. Hypothesis testing about selected theoretical dimensionality of the EA were also evaluated using Confirmatory Factor Analysis.

Materials and Methods

Participants and procedure

Survey data were collected from 1858 residents of Lagos State, Nigeria between January and April 2016. Participants were 34.7±11.0 (Male: 34.7±11.0, Female: 34.7±11.0) years old. Majority (58.9%) of the participants were males while 41.1% were females, and 12.0% of the participants did not complete secondary school education.

The study was community-based consisting of household heads or representatives interviewed in their respective homes. Every household head (or representative), in a systematically selected household who gave informed consent was given the study instrument to complete in English language. In situations where the household head does not understand English language, trained research assistants were available to administer the study instrument in the language understood by the participants. Study instruments were completed by individual participants in a secluded location. In order to avoid information sharing, participants were encouraged to return completed questionnaire within the minimum possible time. Participation in the study was made voluntary and participants were free to quit the study at any stage without any consequence.

Measures

To measure Environmental Attitude (EA), participants completed a 77-item combined EA scale consisting of the New Ecological Paradigm (NEP) Scale, Ecocentric (ECO) Scale, Anthropocentric (ATR) Scale, Motivation Toward the Environment (MTES) Scale and Connectedness to Nature (CNS) Scale. All items on the EA scale were scored on a 7-point Likert-type scales (1 = Strongly Disagree to 7 = Strongly Agree). In addition, data on the participants'

demography including gender, age, family size and other related demographic information were collected using a brief semi-structured questionnaire.

The New Ecological Paradigm (NEP) Scale

The NEP is a 15-item scale developed by Dunlap *et al.*, (2000). The 15-item NEP scale is a revised form of the original 12-item NEP scale earlier developed by Dunlap and Van Liere (1978). The NEP assesses a proposed set of basic beliefs about man's relationship with nature, including the notion that modern societies were upsetting the balance of nature and the need to further emphasize ecocentric orientation toward the environment and nature in general (Amburgey & Thoman, 2011).

Though the NEP scale has been investigated to be multidimensional (Amburgey & Thoman, 2011; Kovacs *et al.*, 2014) in the present study, the one-dimensional NEP (Dunlap *et al.*, 2000; Hawcroft & Milfont, 2010) was used. Using the 7-points scoring systems described above, higher NEP's scores refer to higher ecocentric orientation (Kovacs *et al.*, 2014). The 15-item NEP has been used to assess EA in some settings with reasonable coefficient of reliability. In particular, Dunlap (2000) reported an alpha coefficient of 0.83 for the NEP scale in a previous study and this correlates with other measures of environmental attitudes. In a more recent study, conducted among American and Hungarian middle-class participants, the reliability estimate of the NEP scale was 0.83 and 0.79 respectively (Kovacs *et al.*, 2014).

Ecocentric (ECO) Scale

Ecocentric scale is a 12-item scale designed by Thompson and Barton (1994) to assess respondent's levels of Ecocentrism. It measures specifically the motives of individual to protect the nature because of its intrinsic value so that nature will continue to exist without any external disturbances. The ECO was found to have internal consistency of ($\alpha=0.73$) as assessed in earlier study (Amerigo *et al.*, 2007). In this study, the ECO is rated on the 7-point Likert scale.

Anthropocentric (ATR) Scale

This 12-item scale was designed by Thompson and Barton (1994) to assess respondent's motives that the environment should be protected for human wellbeing. Essentially, Anthropocentrism implies valuing nature because of the material or physical benefits it can provide for human beings (Milfont & Duckit, 2004). Rated on the 7-point Likert scale, like the ECO, higher scores on the ATR indicates greater motives for protecting the environment for the benefit of human. Reliability coefficient for the scale has been reported to be 0.69 (Amerigo *et al.*, 2007), 0.71 (Baltaci, Yiric, Sargin & Yumusak, 2015) and 0.81 (Carmichael, 2000) in previous studies. In the current study, the ATR is considered a one-dimensional subscale of the 77-item EA scale.

Motivation Toward the Environment (MTE) Scale

Motivation Toward the Environment is central to assessing environmental attitude because, it measures the individual's rationale for engaging in environmentally friendly behaviours. In the present study, participant's friendly behaviours towards the environment were assessed using the Motivation towards Environment Scale developed by Pelletier *et al.*, (1998). The MTE consists of 24 items on which participants rated the degree to which various statements indicate their reasons for engaging in environmentally friendly behaviours on a 7-point Likert-type scale. Specifically, participants rated the degree to which they agreed with items such as "I am taking care of the environment because being environmentally conscious has become a fundamental part of who I am". Validated in selected settings, the reliability of the MTE has been shown to be satisfactory (Pelletier *et al.*, 1998; Villacorta *et al.*, 2003).

Connectedness to Nature (CNS) Scale

The connectedness to nature scale was designed by Mayer and Frantz (2004) and measures individuals' trait levels of feeling emotionally connected to the natural environment. Specifically, it assesses continuity between the human being and nature. The CNS is a 14-item scale originally

scored on a 5-point Likert scale (1=strongly disagree to 5=strongly agree), but modified to a 7-point rating scale for the present study without changing the question contents. The CNS was being used in the present study to assess the effects of situational factors and personality characteristic that might influence connection to nature. The CNS scale has been shown to have a good internal consistency ($\alpha = .84$) and test-retest reliability ($r_{tt} = .78, p < .001$) found to significantly predict ecological behaviour and subjective well-being of study participants (Mayer & Frantz, 2004).

Statistical Analysis***Descriptive statistics, Reliability and Correlation analysis***

Frequency table, percentages, mean and standard deviations were used to describe participants' socio-demographic characteristics. Item level and scale characteristics were assessed using mean and standard deviation while Cronbach's Alpha (α) was used to assess the internal consistency of the scale items.

Exploratory Factor Analysis

Series of Exploratory Factor Analyses (EFA) were conducted to investigate the factor structure of the items from the five components EA scales described earlier. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity were conducted to indicate if the data were appropriate for EFA (Akpa *et al.*, 2015). Using Maximum Likelihood (ML) with a direct oblimin rotation and Principal Component Analysis (PCA). Exploratory Factor Analysis was conducted to assess the theoretical factor structure of the combined EA scale. Initially, all the 77 items from the five component scales were allowed to freely load on factors without any constraints on the number of factors to be extracted. In the second EFA strategy, the number of factors to be extracted was limited to five (the number of the component scales). After observing the item loading pattern, the Eigen values of the extracted factors, and the percentage of variance explained by the extracted factors as well the Screen plot in the two EFAs, it was reasonable to extract only three factors.

Consequently, a third EFA was performed where the number of factors to be extracted was limited to three. In all EFAs, items should preferably load ≥ 0.40 (in absolute value) on the relevant factor and < 0.40 on all other factors to be retained (Akpa *et al.*, 2015; Liau *et al.*, 2011). Items loading < 0.40 or loading on more than one extracted factor were excluded from further analysis.

Confirmatory Factor Analysis

Following recommendations in the literature (Liau *et al.*, 2011; Akpa *et al.*, 2015; Yang & Montgomery, 2011), Confirmatory Factor Analysis (CFA) was used to test the goodness of fit of several competing CFA models of the structure of EA scale. The following five CFA models were tested:

Model 1: Single factor structure

This model represents the five component EA scale as a one-dimensional construct of environmental attitude scale. Scores on all 77 EA items were treated as manifestations of the single construct and any potential dimensional differences among scale items are held constant in the model (Amburgey *et al.*, 2011).

Model 2: Correlated Empirical 3-factor structure

This model represents the EA scale as consisting of correlated 3-factor dimensions corresponding to the three factors extracted in the Exploratory Factor Analysis (EFA) conducted on the 77 items of the combined EA scales. The three factors comprised of 57 items and each extracted factor had Eigen value > 2.5 and together, the three factors accounted for approximately 36% of variability in the scale items. The CFA consisted of covariance structure between latent errors with 100 thresholds for modification indices.

Model 3: Correlated Theoretical 3-factor structure

This model represents the EA scale as consisting of correlated 3-factor dimensions comprising of the 77 items of the combined EA scale. As recommended in past literature (Amburgey *et al.*, 2011), this model is a competing multidimensional factor comprising of the combined five components

EA scales (New Ecological Paradigm, ecocentric, anthropocentric, Motivation Toward the Environment, and Connectedness to Nature). The model examined as interdependent factors consisting of three factors as follows: *factor 1* combines Ecocentric and Anthropocentric components of the 77-item EA scale (and is regarded as benefit occasioned by environmental attitudes); *factor 2* combines motivation toward the Environment and Connectedness to Nature (and is regarded as environmental attitudes occasioned by personal emotions toward nature); *factor 3* is the 15-item NEP based on beliefs and notions against disturbance of nature.

Model 4: Correlated Theoretical 5-factor structure

This model represents the EA scale as consisting of correlated five factors dimensions corresponding to the five components EA scales of the 77-item EA scale. This model is akin to the five-factor structure investigated by Dunlap *et al.* (2000) and Amburgey *et al.* (2011). In this model, the combined five component EA scales (New Ecological Paradigm, ecocentric, anthropocentric, Motivation Toward the Environment, and Connectedness to Nature) were examined as independent factors of the theorized environmental attitude. This model serves as a competing conceptualization for assessing whether the five separate EA scales together can be described as orthogonal in nature (Amburgey & Thoman, 2011).

Model 5: Second order structure

This is a five-factor model with two second-order-factor models. It represents the EA scale as consisting of five first-order dimensions (each reflecting one of the combined five component scales), with two second-order factors accounting for the relations among the first-order dimensions. In this model, the five dimensions listed in Model 4 (New Ecological Paradigm, Ecocentric, Anthropocentric, Motivation Toward the Environment, and Connectedness to Nature) are permitted to correlate as interdependent factors comprising respondent's ecological worldview, and variation in these factors is explained by the second-order factors. The model has Ecocentric

and Anthropocentric (two-first-order factors) as well as Motivation Toward the Environment and Connectedness to Nature (another two-first-order factors) subordinated to a single second-order factor each while the NEP scale is left as a first-order component of the model.

Methods for assessing Model fit

Previous studies have recommended that researchers should report multiple fit indices in CFA studies (Liau *et al.*, 2011; Akpa *et al.*, 2015; Yang & Montgomery, 2011;) because varying fit statistics consider different aspects of CFA model fit. Consequently, each model in the present study was evaluated using multiple indices. A model is considered an adequate fit to the data when the chi-square statistics divided by the degrees of freedom is ≤ 3 , the Tucker-

Lewis Index (TLI) is >0.90 , the Goodness of Fit Index (GFI) is >0.90 , the Comparative fit index (CFI) is >0.90 , the Normed Fit Index (NFI) is >0.90 , and the Root Square Means Error of Approximation (RSMEA) is <0.05 . Also, the Consistent Akaike Information Criterion (CAIC) and the Bayesian Information Criterion (BIC) were used for model comparisons, with smaller value indicating a better fit (Akpa & Unuabonah, 2011; Akpa *et al.*, 2015).

Results

Participants' Demography, Scale descriptive and Reliability

Majority (58.9%) of the participants were males, 41.1% were females, while approximately 12% were more than 50 years old. Although most of

Table 1: Socio-demographic Characteristics of Respondents (N=1858)

Variables	Frequency	Percentage (%)
Sex		
Male	1095	58.9
Female	763	41.1
Total	1858	
Current Age		
30	699	37.6
30-49	905	48.7
=50	222	11.9
Not Reported	32	1.7
Total	1858	
Marital Status		
Never Married	711	38.3
Married	1049	56.5
Formerly Married	85	4.6
Not Reported	13	0.7
Total	1858	
Household Size		
≤ 4	1063	57.2
4	786	42.3
Not Reported	9	0.5
Total	1858	
Highest Educational Qualification		
Less than Secondary Education	223	12.0
Secondary Education	516	27.8
Tertiary Non Degree Education	604	32.5
Tertiary Degree/Postgraduate Education	510	27.4
Not Reported	5	0.3
Total	1858	
Occupation		
Unemployed	221	11.9
Self Employed	797	42.9
Private/Public Employees	524	28.2
Students & Others	316	17.0
Total	1858	

them had completed tertiary education (59.9%), 12% did not complete secondary education.

About 43% of the participants were self-employed, 28.2% were employees of public/private organizations, while 11.9% were unemployed (Table 1).

Mean (standard deviation) was 74.97 (13.71) for the composite scores of the NEP scale and ranged from 4.10 (1.91) to 5.44 (1.48) for the

individual items of the NEP scale while estimate of the reliability (cronbach's alpha) was $\alpha=0.80$. Similarly, mean (standard deviation) was 73.52 (12.98) for the composite scores of the CNS scale and ranged from 2.92 (1.46) to 5.48 (1.26) for the individual items of the CNS scale while estimate of the reliability (cronbach's alpha) was $\alpha=0.86$ (Table2).

Table 2: Descriptive statistics and reliability of the environmental attitude's items

Instrument items	M	SD	alpha
NEP	74.97	13.709	0.797
We are approaching the limit of the number of people the earth can support	4.64	1.915	
Humans have the right to modify the natural environment to suit their needs	4.87	1.825	
When humans interfere with nature it often produces disastrous consequences	5.10	1.710	
Human ingenuity will insure that we do not make the earth unlivable	4.79	2.074	
Humans are severely abusing the environment	5.43	2.262	
The earth has plenty of natural resources if we just learn how to develop them	5.18	1.788	
Plants and animals have as much right as humans to exist	5.29	1.522	
The balance of nature is strong enough to cope with the impacts of modern industries	4.83	1.669	
Despite our special abilities humans are still subject to the laws of nature	5.26	1.578	
The so-called "ecological crisis" facing humankind has been greatly exaggerated	4.10	1.911	
The earth is like a spaceship with very limited room and resources	4.79	1.810	
Humans were meant to rule over the rest of nature	4.96	1.816	
The balance of nature is very delicate and easily upset	5.25	1.569	
Humans will eventually learn enough about how nature works to be able to control it	5.03	1.748	
If things continue on their present course, we will soon experience a major ecological catastrophe	5.44	1.483	
ECO	62.09	10.444	0.796
One of the worst things about overpopulation is that many natural areas are getting destroyed for development	5.52	1.535	
I can enjoy spending time in natural settings just for the sake of being out in nature	5.48	1.374	
Sometimes it makes me sad to see forests cleared for agriculture	5.27	1.590	
I prefer nature reserves to zoos	5.29	1.510	
I need time in nature to be happy	5.39	1.464	
Sometimes when I am unhappy I find comfort in nature	5.45	1.381	
It makes me quite sad to see environments destroyed	5.46	1.434	
Nature is valuable for its own sake	5.31	1.575	
Being out in nature is a great stress reducer for me	5.39	1.523	
One of the most important reasons to conserve is to preserve unspoilt areas	5.60	1.422	
Sometimes animals seem almost human to me	3.23	1.995	
Humans are as much a part of the ecosystem as other animals	4.68	1.890	
ATR	64.50	11.266	0.878
The worst thing about the loss of the rain forest is that it will restrict the development of new medicines	5.29	1.533	
It bothers me that humans are running out of their supply of oil	5.28	1.482	
The thing that concerns me most about deforestation is that there will not be enough timber for future generations	5.49	1.451	
The most important reason for conservation is human survival	5.47	1.366	
One of the best things about recycling is that it saves money	5.51	1.369	
Nature is important because of what it can contribute to the pleasure and welfare of humans	5.52	1.347	
We need to preserve resources to maintain a high quality of life	5.50	1.366	
One of the most important reasons to conserve the environment is to ensure a continued high standard of living	5.32	1.437	
Continued land development is a good idea as long as a high quality of life can be preserved	5.28	1.442	
The best thing about camping is that it is a cheap vacation	5.00	1.590	
One of the most important reasons to keep rivers and lakes clean is so that people can have a place to enjoy water sports	5.15	1.578	
Human should endeavour to always keep the environment clean	5.68	1.253	

Cont'd

MTE	106.58	16.895	0.803
For the pleasure I experience while I am mastering new ways of helping the environment	5.28	1.471	
For the pleasure I experience while improving quality of environment	5.47	1.792	
Because I like the feeling I have when I do things for environment	5.44	1.412	
For the pleasure I get from contributing to the environment	5.52	1.352	
Because taking care of the environment is an integral part of my life	5.46	1.418	
Because it seems to me that taking care of myself and taking care of the environment are inseparable	5.42	1.398	
Because it's part of the way I've chosen to live my life	5.34	1.405	
Because being environmentally-conscious has become a fundamental part of who I am	5.46	1.312	
Because it's a sensible thing to do in order to improve the environment	5.52	1.350	
Because it's a way I've chosen to contribute to a better environment	5.54	1.331	
Because it is a reasonable thing to do to help the environment	5.61	1.359	
Because I think it's a good idea to do something about the environment	5.55	1.420	
I think I'd regret not doing something for the environment	4.98	1.830	
Because I would feel guilty if I didn't do anything for the environment	5.07	1.809	
Because I would feel bad if I didn't do anything for the environment	3.47	1.941	
Because other people will be upset if I don't	3.09	1.736	
For the recognition I get from others	3.11	1.765	
Because my friends insist that I do it	3.02	1.793	
To avoid being criticized	3.03	1.880	
I wonder why I'm doing things for the environment; the situation is simply not improving	3.13	1.891	
Honestly, I don't know; I truly have the impression I'm wasting time doing things for the environment	3.00	1.914	
I don't know; I can't see how my efforts to be environmentally-conscious are helping the environmental situation	3.03	1.896	
I don't really know; I can't see what I'm getting out of it	3.00	1.904	
Because I would feel ashamed of myself if I was doing nothing to help the environment	3.05	1.927	
CN	73.52	12.976	0.863
I often feel a sense of oneness with the natural world around me	5.22	1.51	
I think of the natural world as a community to which I belong	5.37	1.29	
I recognize and appreciate the intelligence of other living organisms	5.48	1.26	
I often feel disconnected from nature	3.33	1.79	
When I think of my life, I imagine myself to be part of a larger cyclical process of living	5.07	1.56	
I often feel a kinship with animals and plants	4.91	1.71	
I feel as though I belong to the Earth as equally as it belongs to me	5.27	1.45	
I have a deep understanding of how my actions affect the natural world	5.38	1.44	
I often feel part of the web of life	5.07	1.47	
I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	5.12	1.46	
Like a tree can be part of a forest, I feel embedded within the broader natural world	5.01	1.39	
When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature	2.92	1.46	
I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees	4.27	1.87	
My personal welfare is independent of the welfare of the natural world	3.29	1.76	
Overall combined EA scale	381.70	48.95	0.928

NEP- New Environmental Paradigm, ECO- Ecocentric, ATR- Anthropocentric, MTE -Motivation Toward the Environment, CN- Connectedness to Nature

Exploratory Factor Analysis

The rationale for the exploratory factor analysis (EFA) was to test whether the 5-factor theoretical models for the combined EA scales will be identified or an alternative solution would better fit the dataset. The measure of sampling adequacy assessed by the Kaiser–Meyer–Olkin (KMO) showed adequate fit (KMO=.939). Results of the Exploratory Factor Analysis (EFA) showed a 3-factor model with Eigen-values greater than 2.5

for each factor (Factor1: 18.4, Factor2: 6.37, Factor3: 2.77) as a better fit to the data. The three factors accounted for approximately 36% cumulative variance in the scale item scores. The factor loading between each item and extracted factors showed a total of 57 of the 77 items (43 for factor 1, 8 for factor 2 and 6 for factor 3), loaded on the 3 factors extracted (Table 3).

The results further showed that none of the component scale of the combined EA was

completely identified by the items theoretically intended to represent them. Some items theoretically intended to represent these scales either loaded on a different scale, cross loaded on more than one scale or did not load on any scale at all (Table 3). In particular, the first factor (Factor 1) was disproportionately presented with more items than the other factors (Factors 2 and 3) which were presented with as few as 8 and 6 items respectively, in the present analysis.

For instance, Factor 3 had three items ("*Humans have the right to modify the natural environment to suit their needs*", "*Human ingenuity will insure that we do not make the earth unlivable*" and "*The balance of nature is strong enough to cope with the impacts of*

modern industries") loading on it from the NEP scale and two other items ("*When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature*" and "*My personal welfare is independent of the welfare of the natural world*") loading on it from the MTE scale (Table 3) and seems to represent "Motivation for Human Dominance/Altering Nature". Factor two consisted mainly of items from the MTE (Table 3) and seems to represent "Extrinsic and Anti-centric attitude" while factor one consisted of selected items across the five component scales included in the analysis and could be regarded as "Generalized Environmental Attitude".

Table 3: Factor loading for the Exploratory Factor Analysis with Maximum Likelihood extraction method

Instrument items	Factor 1	Factor 2	Factor 3
NEP			
Humans have the right to modify the natural environment to suit their needs			0.45
Human ingenuity will insure that we do not make the earth unlivable			0.44
The balance of nature is strong enough to cope with the impacts of modern industries			0.53
Despite our special abilities humans are still subject to the laws of nature	0.40		
The balance of nature is very delicate and easily upset	0.42		
If things continue on their present course, we will soon experience a major ecological catastrophe	0.52		
ECO			
One of the worst things about overpopulation is that many natural areas are getting destroyed for development	0.59		
I can enjoy spending time in natural settings just for the sake of being out in nature	0.57		
Sometimes it makes me sad to see forests cleared for agriculture	0.40		
I prefer nature reserves to zoos	0.42		
I need time in nature to be happy	0.48		
Sometimes when I am unhappy I find comfort in nature	0.49		
It makes me quite sad to see environments destroyed	0.44		
Being out in nature is a great stress reducer for me	0.44		
One of the most important reasons to conserve is to preserve unspoiled areas	0.47		
ATR			
The worst thing about the loss of the rain forest is that it will restrict the development of new medicines	0.66		
It bothers me that humans are running out of their supply of oil	0.55		
The thing that concerns me most about deforestation is that there will not be enough timber for future generations	0.64		
The most important reason for conservation is human survival	0.61		
One of the best things about recycling is that it saves money	0.59		
Nature is important because of what it can contribute to the pleasure and welfare of humans	0.63		
We need to preserve resources to maintain a high quality of life	0.61		
One of the most important reasons to conserve the environment is to ensure a continued high standard of living	0.59		
Continued land development is a good idea as long as a high quality of life can be preserved	0.47		
The best thing about camping is that it is a cheap vacation			
One of the most important reasons to keep rivers and lakes clean is so that people can have a place to enjoy water sports			

Cont'd

Instrument items	Factor 1	Factor 2	Factor 3
MTE			
For the pleasure I experience while I am mastering new ways of helping the environment	0.74		
For the pleasure I experience while in improving quality of environment	0.53		
Because I like the feeling I have when I do things for environment	0.70		
For the pleasure I get from contributing to the environment	0.68		
Because taking care of the environment is an integral part of my life	0.72		
Because it seems to me that taking care of myself and taking care of the environment are inseparable	0.69		
Because it's part of the way I've chosen to live my life	0.67		
Because being environmentally-conscious has become a fundamental part of who I am	0.65		
Because it's a sensible thing to do in order to improve the environment	0.64		
Because it's a way I've chosen to contribute to a better environment	0.54		
Because it is a reasonable thing to do to help the environment	0.58		
Because I think it's a good idea to do something about the environment	0.53		
For the recognition I get from others		0.63	
Because my friends insist that I do it		0.73	
To avoid being criticized		0.75	
I wonder why I'm doing things for the environment; the situation is simply not improving		0.79	
Honestly, I don't know; I truly have the impression I'm wasting time doing things for the environment		0.75	
I don't know; I can't see how my efforts to be environmentally-conscious are helping the environmental situation		0.74	
I don't really know; I can't see what I'm getting out of it		0.70	
Because I would feel ashamed of myself if I was doing nothing to help the environment		0.46	
CN			
I often feel a sense of oneness with the natural world around me	0.69		
I think of the natural world as a community to which I belong	0.64		
I recognize and appreciate the intelligence of other living organisms	0.61		
I often feel disconnected from nature			0.40
When I think of my life, I imagine myself to be part of a larger cyclical process of living	0.56		
I often feel a kinship with animals and plants	0.45		
I feel as though I belong to the Earth as equally as it belongs to me	0.58		
I have a deep understanding of how my actions affect the natural world	0.58		
I often feel part of the web of life	0.57		
I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	0.56		
Like a tree can be part of a forest, I feel embedded within the broader natural world	0.54		
When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature			0.56
My personal welfare is independent of the welfare of the natural world			0.51
Total Eigen value	18.4	6.372	2.765
% Variance Explained	23.897	8.276	3.59
Kaiser-Meyer-Olkin measure of sampling adequacy(KMO)		0.939; p=0.000	

NEP- New Environmental Paradigm, ECO- Ecocentric, ATR- Anthropocentric, MTE -Motivation Toward the Environment, CN- Connectedness to Nature

Confirmatory Factor Analysis and Model Comparison

Based on the results of the confirmatory factor analysis (CFA), a 3-factor non-orthogonal model yielded better fit indices (and goodness of fit) compared to the theoretical and other competing

models considered in the present analysis. In the CFA, 5 competing models were tested for goodness of fit using Confirmatory Maximum Likelihood estimation procedures (DUKIT, 2004). Generally, the results yielded relatively poor fit for all models except for Model 2 with an acceptable fit (Table 4).

In particular, results indicated a poor fit for Model 1 [$\chi^2=434493.747$; $df=2851$ $\chi^2/df=152.400$; RMSEA=0.088; GFI=0.495, CFI=0.445], Model 3 [$\chi^2=11497.846$; $df=1951$ $\chi^2/df=5.893$; RMSEA=0.051; GFI=0.807, CFI=0.143], Model 4 [$\chi^2=37685.991$; $df=2839$ $\chi^2/df=13.275$; RMSEA=0.081; GFI=0.525, CFI=0.524] and Mode 5 [$\chi^2=40191.171$; $df=2847$ $\chi^2/df=14.117$; RMSEA=0.084; GFI=0.525, CFI=0.490]. Though the cut-off points for the fit indices were not met by any of the models, Model 2 performed better than all other competing models. For instance, model 2 was a significant improvement over model 3 [$\chi^2(456)=3028.182$, $P<0.001$; CAIC=9816.870] and Model 4 [$\chi^2(1344)=29216.327$, $P<0.001$; CAIC=9816.870] and therefore provided the better fit to the data.

Table 4: Confirmatory Factor Analysis, Goodness of fit and fit indices for the EA scales

Model	χ^2	df	χ^2/df	RMSEA	CAIC	BIC	GFI	NFI	RFI	IFI	TLI	CFI
Model 1: Single factor structure	434493.747**	2851	152.400	0.088	44789.890	44637.890	0.495	0.428	0.413	0.445	0.430	0.445
Model 2: Correlated empirical 3-factor structure	8469.664**	1495	5.665	0.050	9816.970	9658.970	0.855	0.851	0.841	0.874	0.865	0.874
Model 3: Correlated theoretical 3-factor structure	11497.846**	1951	5.893	0.051	12598.862	12468.862	0.807	0.126	0.097	0.148	0.114	0.143
Model 4: Correlated theoretical 5-factor structure	37685.991**	2839	13.274	0.081	39084.461	38920.461	0.525	0.505	0.490	0.524	0.509	0.524
Model 5: 2 nd order structure	40191.171**	2847	14.117	0.084	41521.423	41365.423	0.525	0.472	0.457	0.490	0.475	0.490

** - $p<0.01$

df- Degrees of freedom, *GFI*-Goodness of Fit Index, *TLI*-Tucker-Lewis Index, *CFI*-Comparative Fit Index, *NFI*-Normed Fit Index, *RMSEA*-Root Square Means Error of Approximation, *RFI*-Relative Fit Index, *IFI*- Incremental Fit Index
CAIC-Consistent Akaike Information Criterion, *BIC*-Bayesian Information Criterion

Discussion

In the present study, we assessed the psychometric properties and factor structure of a combined environmental attitude scales which was a combination of 5-independent but intrinsically related measures of different facet of ecological world view. The intentions were to demonstrate the appropriateness of pulling such scales together to assess environmental attitude in a setting like Nigeria, to report data that demonstrates the internal consistencies of the items as well as an appropriate model or factor structure that best fit our empirical data collected from a community based study.

Overall, assessing the 5 combined EA scales as a one-dimensional scale and independently showed high internal consistency for the individual scales and the combined EA scale. From these preliminary results, it seems, therefore, that though the component scales could be independently used to measure the varying facet of environmental attitude; EA can as well be measured using the 5 primary factors together. Similar findings have been reported in a previous related study where independent measures were combined to assess EA (Milfont & Duckitt, 2004; Milfont & Duckitt, 2010). Specifically, in a cross-sectional study among 314 psychology students at the University of Auckland, New

Zealand, Milfont & Duckitt (2010) reported an overall highly satisfactory alpha coefficient, ranging from 0.72 (for the altering nature scale) to 0.89 (for the environmental activism scale). In addition, in a more recent and robust survey (among 1082 rural landowners and recreationists) to examine the multi-dimensional structure of pro-environmental behaviour, a mixed-methods study was conducted among rural residents of New York, USA and alpha coefficient ranged from 0.64 (for the Land stewardship behaviors scale) to 0.84 (for the Environmental citizenship behaviours scale) (Larson *et al.*, 2015). These results indicated that a practice of combining independent EA scales for assessing ecological worldviews could be used in both defined subpopulation(s) and general population based studies.

Although the data set used for the present analysis was found to be adequate for a factor analysis, the original 5-factor structure of the combined EA scale was not uniquely identified. A non-orthogonal 3-factor structure was found to fit the data better than other competing models in the analysis. Items loaded on the extracted factors arbitrarily from each of the five original scales indicated that one-dimensionality or orthogonality of the factors was less supported by the empirical data used for the present analysis. Our findings in part, support the

hypothesis that EA contained multiple domains that cannot be measured using an aggregated or uni-dimensional scale (Milfont & Duckitt, 2004; 2010; Larson *et al.*, 2015), and that these facets are better represented as correlated rather than orthogonal structures. To further support this finding, previous studies on a scale like NEP (one of the component scales) revealed that it cannot be unilaterally treated as a one-dimensional scale (La Trobe & Acott, 2000; Lalonde & Jackson, 2002; Lück, 2003; Manoli, Johnson & Dunlap, 2007). On the other hand, the empirical evidence reported by Milfort and Duckit (2004) revealed a two-dimensional model of EA after an analysis of aggregated well-established EA scales consisting of the New Ecological Paradigm Scale, Ecocentric and Anthropocentric Environmental Attitude Scales, Ecological World View Scale and ENV scale. A confirmatory factor analysis further revealed that a Correlated two-factor first-order model was better suited for the data used for the study (Milfort & Duckit, 2004).

Similarly, in the present study, the conceptualization of the EA using the five component scales was not confirmed by the Confirmatory Factor Analysis performed on the data and none of the CFA models provided an excellent fit to the data. However, after some modifications, a correlated 3-factor structure suggested by the EFA was a significant improvement over the other four competing models considered in the present study. It is likely that the results reported in this paper provide empirical evidence for a correlated three-dimensional model of EA in the setting of the present study. Unfortunately, we do not have comprehensive similar reports in this locality with which to compare this present finding. Notwithstanding, reports from several related studies elsewhere demonstrates the theoretical relevance of the present reports (Milfort & Duckit, 2004; Milfont & Duckitt, 2010; Larson *et al.*, 2015).

Although this study provides an initial evaluation of the structure of Environmental Attitudes scale in a community based study in Nigeria, it has some limitations worth highlighting. First, the sample consisted of only residents in

five selected Local Government Areas (local administrative areas) in Lagos state, Nigeria. Study participants in such locations may be more educated and therefore more knowledgeable about the environment than the general population in Nigeria and other similar African settings. Also, future studies examining the dimensionality of EA could be expanded to include a broader array of participants across different economic and socio-cultural population stratifications in different settings.

Notwithstanding, sampling strategies and the robust sample size included in the present study provided some control against biases. Also, in the present study, we have attempted to assess the multi-dimensionality of the EA using well-established component scales. A participant-driven approach to EA conceptualization and measurement might yield a more unique multi-dimensional structure in African settings where public appraisals of pro-environmental behaviours and their respective impacts are very likely to differ.

Conclusion

The results of this study show that the five components EA scales used in the present analysis are well-established scales and are found to have high Cronbach's alpha coefficient suggesting that they may be used in Nigeria and similar settings with some level of assurance of reliability. Future research on EA in this and related issues should preferably use non-orthogonal 3-factor structure. Also, using numerous hypothetical CFA models with multiple fit indices may be useful in ascertaining the best fit to future empirical study. Future studies should be directed towards the indices to determining how best to combine various measures of scale such that it can produce result appropriately fit for CFA analysis and the criteria for assessing model fit. Apart from that, the conceptualization of the EA as a non-orthogonal 3-factor structure (as found in the present study) may likely provide a better fit to data from related studies in the present and similar study settings.

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Conflict of Interest

The authors have no conflict of interest to report.

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