

Measuring New Environmental Paradigm Based on Students' Knowledge About Ecosystem and Locus of Control

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This research is aimed at obtaining information related to instrument development of Students' New Environmental Paradigm (NEP) based on their knowledge about ecosystem and Locus of Control (LOC). A survey method has been carried out by selecting senior high school students randomly with $n = 362$ (first stage 2013) and $n = 722$ (2014). Data analysed by correlational analysis, alpha Cronbach and Factor analysis (CFA). Research results reveal that there is no significant difference between two means of students NEP of 2013 and 2014 data. Internal consistency and high items validity found among items developed in 2013 and 2014. Reliability coefficient is also high (.905/2013 and .908/2014). Only knowledge about ecosystem has significant first order correlation with students NEP (.249/ $n = 722/2014$). It is found also that there are three factors do not have "factor loading" equal to or more than .30, therefore, it should be omitted for next research. It is sound to be uni dimension with 12 factors (from 15 factors), based on 5 dimensions (62 becomes 46 items). It could be concluded that number of items and sample size affect instrument reliability and students NEP could be measures empirically.

Keywords: New Environmental Paradigm (NEP), knowledge about ecosystem, Locus of Control (LOC), factor analysis.

INTRODUCTION

National development design has changed into an economic growth regardless pay attention on environmental degradation. Economic growth is also recognized in several countries with lack of intention in how to include the poor people. Therefore, two important issues such as environmental and poverty issues would be hard to be avoided or overcome. Sustainable development just as goals of any development, not a tool, not a strategy. It could be proven that sustainable development, even it has been declared 26 years ago (1987), it could not stopped that

global warming or climate change still continuously affect the only one our planet. It requires some strategies unless our environment could not be saved from human intervention.

If it is believed that human activities have a vital role in destructing our environment, therefore the target of any activities would be human being. Education is a tool, in this case, which its aim at improving the awareness, knowledge, attitudes even personality or behavior of human being. Education has the power to change, in a long time, human behavior through his or her knowledge, attitudes or personality. Those process would be running with process of learning, socialization, and internalization which could take long time until achieve the goal.

Because of education is presumed to be the most influencing factors in determining human behavior rationally toward the environment, therefore the process of teaching and learning is one of the promising programs for the future. In this case, teachers have a

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State of the literature

- The way people perceive or view the world, more specific is environment, determined by their paradigm which would be probably affect their behavior toward environment. There are many evidences that people start moving their negative paradigm toward world view or environmental view to proenvironment which is called New Environmental Paradigm (NEP), therefore measuring people paradigm toward environment need an equipment or tool which is called instrument.
- In developing an instrument, concept of validity and reliability are required as criteria which come up with new instrument, in this case, NEP instrument which close to be standard. Instrument standardization is needed due to NEP is a construct which required to be validated scientifically through steps in accordance to instrument development research based on measurement theories.
- As a construct, therefore, confirmatory factor analysis (CFA) is used to verify its construct validity based on 5 dimensions for measuring NEP. Moreover, NEP as one of factors which determine people behavior related to how they perceive the environment.

Contribution of this paper to the literature

- In NEP instrument development, it has been proven that knowledge about ecosystem contributes significantly in constructing NEP items, based constantly on NEP 5 dimensions; therefore, another factor such as locus of control can be neglected.
- A positive contribution is given by this research, not merely to enrich concept of measurement but to prove that in developing an instrument with its items, support a quantitative research as well.
- A number of items and sample size determine instrument validity and reliability, and these findings could enrich our literatures related to concepts of measurement, so those factors should be taken into consideration in any instrument development, especially non cognitive instrument, where the more the number of items indicates high its content validity, the higher its items validity and reliability would be. The same thing also related to sample size.

vital role in affecting students awareness, attitudes or even behavior.

Related to the environment, there are many scholars have a different perception on what human traits should

be improved. It could be human cognitive, affective or psychomotor, however another scholar interested in improving human paradigm. If we want to change effectively we should work with paradigm, not merely talking about attitude, skill, or behavior. A quantum improvement would be happened when we work with paradigm (Covey, 2008).

Dealing with environment, there are two kinds of paradigm perceived by human being. Dominance Social Paradigm (DSP) characterized by human thought that ecosystem or environment could be destructed because its has an ability to recover by itself. According to this paradigm, natural resources are unlimited, so it could be utilized irrationally for fulfillment human basic needs. Human has the power over the nature which scientifically called Anthropocentrism

On the other hand, the good one is called New Environmental Paradigm (NEP) which has reversely characteristics with DSP. This paradigm assume that human being is a part of ecosystem and natural resources is very limited to be utilized and tend to be extinction. So, by this paradigm teach us to love with environment and live with it harmoniously. Therefore, on this opportunity improving students' NEP would be beneficial to be carried out.

Why paradigm, why not students attitude or behavior or perception etc.? This question will lead us to an answer that when we are going to improve something which is in a "quantum leap," therefore we will work on paradigm (Covey, 2008). He stated that "If you want to make minor, incremental changes and improvements, work on practices, behavior or attitude, But if you want to make significant, quantum improvement, work on Paradigms." 1

Based on those problem backgrounds, research problem could be formulated as follows "how to develop students NEP Instrument (scale) based on students knowledge and locus of control (LOC)?" In order to solve this problem, some definitions related to variables should be defined. Some scholars said that paradigm is a set of values which form pattern of thinking as a base for their view, so it will develop an image about reality and finally will determine how someone response to its reality.

NEP scale is considered a measure of environmental world view or paradigm (framework of thought, in Anderson, 2012, pp. 260-262). He also stated that "... world view of population called dominant social paradigm (DSP), was changing to reflect greater environmental concern." He continued that " NEP scale could measure where population was in transition from DSP to a New environmentally conscious world view."

NEP's original 12 items were successfully reduced to 6 items by Steger, et.al. (1989, in Geno, 2000, p.2). Dunlap, et.al., (2000, p. 434) stated that "15 items can

legitimately be treated as measuring a single construct.” Those 15 items developed by Dunlap, et.al. (2000, p.435) were based on 5 dimensions namely, limits to growth, anti-anthropocentrism, balance to nature, anti-exempt, and eco crisis.

Related to knowledge, Hegel stated that scientific knowledge and human thinking in general, is a change process from Think-In-Itself, into Think-For-Us, from the nature of materials into something useful for us. It means that what has been not understood at one stage will be explainable.

Bloom (1981) then described that knowledge involved the description about situation focusing on recalling about ideas, objects and other phenomena. Based on its aspects, He also classified knowledge into three groups (1) knowledge about facts and terms, (2) knowledge about problem solving which consist of knowledge about classification, methods, categorical, trends, etc. and (3) knowledge about principles, theory and criteria.

Anderson and Krathwohl (2002) have contributed in developing new dimensions which they called as “a cognitive process.” It consists of (1) knowledge about fact (2) knowledge about concepts; (3) knowledge about procedural, and (4) metacognitive knowledge. Structurally, it is close to what has been developed by Bloom (1981), but analytical and synthesis pattern of thinking have been integrated into analytical thinking and they put final process with what they called “creation.”

Related to this study, knowledge about ecosystem is one of the variables, therefore, knowledge about ecosystem means all things that relevant to ecosystem concepts which consist of food chain concepts, energy, limiting factors, and biogeochemical cycles. Based on definition as define by Odum (2005), ecosystem is an interrelated and interaction among abiotic and biotic components in natural or artificial system, functionally and structurally. Those components are inseparable because if one component be destructed, then it would be followed by other components destruction. This is a basic principle of ecosystem, so balancing in nature and put human being as part of ecosystem are some of indicators in measuring environmental paradigm.

Knowledge about ecosystem would be presumably lead to changes in human attitudes and finally direct his/her behavior, but it depends mostly on how human being view this world comprehensively.

According to Bengen (2002), in order to utilize natural resources and its ecosystem rationally, it requires human efforts in conserving biodiversity and try to avoid its crisis and destruction by applying environmental regulations, laws, and policies which environmentally and sustainability sound.

Locus of control, according to Rotter (1978 in Schunk, Pintrich, dan Meece, 2008:224), refers to social

learning theory.” Basically, locus of control describe about control location in individual personality related to its environment.

Then, Rotter (in Schunk, Pintrich, and Meece, 2008:244) differentiate locus of control orientation into internal and external locus of control. An individual with internal locus of control internal tend to perceive that skill, ability, and effort are more as determinant factors related to what they have got in their life.

On the other hand, an individual with external locus of control tend to perceive that their life determined by the power from outside of them such as faith, luck or someone else which has the power. Therefore, it could be concluded that internal locus of control is much better than external locus of control, because as what predicted by Rotter (in Friedman & Schustack, 2002), external locus of control tend to be dependent and getting easier to become depression and stress and more defensive or passive when they face stressors.

Greenberg & Baron (2010, p.146) defined that “locus of control is the extent to which individuals that they are able to control things in a manner that affects them.” Moreover, Robbin & Judge (2013) stated that in organization, an individual with internal locus of control tend to (1)more taking part actively in running the organization; (2) has more clear in doing jobs; and (3) tend to choose decentralized organization.

On other occasion, McShane & Glinow (2010) stated that “locus of control refers to a generalized belief about the amount of control people have over their own lives” In organization, according to George & Jones (2012) describe that individual with internal locus of control is easier to be motivated than external locus of control. Individual with internal locus of control does not require a lot of direct due to their beliefs that work behavior affect good performances, well paid, compensation, reward and even promotion.

Those explanation supported by Kinicki and Kreitner (2011, p. 133) which stated that “people who believe they control the events and consequences that affect their lives are said to possess an internal locus of control.”

More detail explanation proposed by Certo & Certo (2012) which stated that locus of control is someone beliefs about his/her behavior and when it is depended on events in side control of him/herself called internal control orientation or depended on events that occurred at outside of individual control called external control orientation.

RESEARCH METHODOLOGY

This research is aim at obtaining information related to instrument development of Students' New Environmental Paradigm (NEP) based on their knowledge about ecosystem and Locus of Control

(LOC). Therefore, a survey method used to achieve this objective by involving senior high school students from 3 different big cities, Palembang (n = 117), Jakarta (n = 125) and Makassar (n = 120) which selected randomly. Total amount of sample is 362 and this is at the first stage of this study conducted in 2013.

For the second stage (2014), total amount of sample is 722 and selected after taken by applying multi stage random sampling in those same three cities. This number of sample is in accordance to what has been suggested by some of text books, especially in developing instrument study, it should be twice as many as a number of first stage sample.

There are 3 instruments developed for this study, instrument for measuring NEP (62 items at first stage study, but for second stage, number of items became 46, due to 3 factors have been omitted which have < .30 of factor loading after varimax rotation), LOC (17 items) and Knowledge (17 items). Those instruments have been developed based on theoretical or content validity, conceptual and operational definitions as a basic in developing "table of specification" (Anastasi, 2002). Each of those instruments have been validated by calculating their items validity and Reliability coefficient (before and after non valid items have been eliminated).

Locus of control (LOC) has been developed by adapting Rotter (1978) instrument which consist of two choices, A or B, and for internal LOC statement, the score was 2 and external should be scored 1. Knowledge about ecosystem (Eco) is also developed based on Bloom (1971) dimension of knowledge, knowledge of fact and knowledge of principle related to concepts of ecosystem, interaction, energy and limiting factor. Two-choices, True-False is form of knowledge test with scoring 0-1.

NEP conceptually has been defined as people views

toward their environment which consisting of 5 dimensions (based on Dunlap, et.al, 1978): (1) Limits to growth (13 items); (2) Anti-anthropocentrism (13 items); (3) Balance of nature (13 items); (4) Rejection of Exemptionalism (11 items) and (5) Eco-crisis (12 items). Therefore, there are around 62 items which each of dimension consists of 3 factors.

In order to be easier in measuring students' NEP, Table 1 depicts some indicators (factors) which it will be validated its construct validity by applying factor analysis (EFA). In analyzing the data, particularly for measuring students' NEP, factor loading of each factor as a determinant key in finding out which factors should be omitted. According to Hair, et.al. (2011, p.117), factor loading above of .30 is significant if sample used is more than 350, so in this case, sample size is 362 and 722

RESEARCH FINDINGS

Based on descriptive data analysis, it has been found that NEP means difference between 2013 versus 2014 data is not significant, even number of sample is much bigger in 2014 and this finding is what has been expected, it reflects items consistency in measuring NEP from time to time. It is also followed by LOC and students knowledge about ecosystem.

In order to know whether NEP instrument mostly determined by LOC or knowledge, correlation analysis found that both LOC and knowledge has a significant first order correlation with students NEP (with LOC = .442 and with knowledge = .281, 2013 data). Another findings, however, 2014 data with n = 722, it is found that knowledge is the only variable correlated significantly with NEP after LOC has been controlled ($r = .249$). This finding is really fit with NEP instrument development because starting from beginning; most

Table 1. Specification for Measuring Students' NEP

Dimensions	Indicators/Factors	Items Number
1. Limits to Growth	X1.1. Population growth	1,2,5,34,40
	X1.2. Nature conservation	3,10,13,59
	X1.3. Short/limiting resources	4,50,53,57
2. Anti-anthropocentrism	X2.1. Right for living	12,33
	X2.2. Modifying nature based on human needs	6,8,15,43,44,47,51
	X2.3. Arrange the nature rationally	7,9,11,14
3.The Fragility of Natures Balance	X3.1. Environmentally sound technology Util.	19,23,24,46
	X3.2. Economic and ecological balances	16,37,58,60
	X3.3. Sensitive balance of nature	17,18,45,49,61
4. Rejection of Exemptionalism	X4.1. Natural laws and principles restriction	27,28,41,56
	X4.2. Rational nature utilization	22,31,38
	X4.3. Natural ability to survive	21,36,62,39
5.The Possibility of an Eco crisis	X5.1. Irrationally activities toward nature	20,25,29,52,54
	X5.2. Natural balances destruction	26,30,48,55
	X5.3. Concern with sustainable development	32,35,42

items actually characterize students' knowledge about ecosystem in measuring environmental world view. Therefore, in next NEP instrument development, knowledge about ecosystem would be taken into account.

Related to items validity, there are only 6 items are not valid using 2013 data and these items have been omitted because those items are also included on factors which has low factor loading (factors X.1.1 and X.2.2, see table of specification about NEP). But, in 2014 data shows that all 46 items are valid. Reliability coefficients respectively 2013 and 2014 data are .90 and .908 and these results are very different coefficient when it is compared with Waikato research report (2013) which reliability coefficients respectively .6261 (2000), .621 (2004) and .422 (2008) by using six NEP items.

When 15 items used, reliability coefficients found around .83 with items validity range from .33 to .62 (in Waikato Report, 2013, p.30). According to Dunlap, et.al. (2000, p.434) that "... coefficient alpha is a very respectable .83."

Based on factor analysis, it is found that there are two components related to eigenvalues which > 1.00 for 2013 data (6.306 and 1.207) and only one component for 2014 data (5.921). This result means that rotation only could be carried out for 2013 data as shown from these table 2 and table 3.

Table 4 and table 5 depict the values of factor loading before rotation, for 2013 and 2014 data. For 2014 data, approaching the unidimensionality has been achieved where all the rest of factors, around 12 factors with 46 items are recommended to be implemented for

Table 2. Total Variance Explained (2013)

Comp	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Tot	% of Var	Cum %	Tot	% of Var.	Cum %	Tot	% of Var.	Cum %
1	6,306	42,042	42,042	6,306	42,042	42,042	4,675	31,169	31,169
2	1,207	8,043	50,085	1,207	8,043	50,085	2,837	18,916	50,085
3	,890	5,935	56,020						
4	,827	5,514	61,534						
5	,784	5,230	66,763						
6	,689	4,594	71,358						
7	,631	4,206	75,563						
8	,589	3,928	79,491						
9	,578	3,853	83,344						
10	,497	3,317	86,661						
11	,446	2,976	89,637						
12	,426	2,839	92,476						
13	,408	2,723	95,199						
14	,375	2,497	97,696						
15	,346	2,304	100,000						

Extraction Method: Principal Component Analysis.

Table 3. Total Variance Explained (2014)

Comp	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Tot	% of Var	Cum %	Tot	% of Var	Cum %
1	5,921	49,339	49,339	5,921	49,339	49,339
2	,814	6,780	56,120			
3	,737	6,144	62,264			
4	,699	5,823	68,087			
5	,625	5,207	73,294			
6	,542	4,521	77,814			
7	,529	4,404	82,219			
8	,514	4,280	86,498			
9	,469	3,905	90,404			
10	,432	3,600	94,004			
11	,375	3,126	97,130			
12	,344	2,870	100,000			

Extraction Method: Principal Component Analysis

Table 4. Component Matrix^a (2013)

	Component	
	1	2
X1.1	,421	,641
X1.2	,638	,074
X1.3	,732	-,238
X2.1	,523	-,229
X2.2	,633	,455
X2.3	,615	,211
X3.1	,564	,337
X3.2	,695	-,240
X3.3	,613	,002
X4.1	,672	-,124
X4.2	,697	-,065
X4.3	,763	-,172
X5.1	,741	-,362
X5.2	,744	-,113
X5.3	,578	,256

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Table 5. Component Matrix (2014)

	Component
	1
X1.2	,675
X1.3	,758
X2.1	,562
X2.3	,668
X3.2	,736
X3.3	,669
X4.1	,693
X4.2	,718
X4.3	,807
X5.1	,766
X5.2	,757
X5.3	,579

Table 6. Rotated Component Matrix^a (2013)

	Component	
	1	2
X1.1	-,015	,767
X1.2	,485	,422
X1.3	,738	,218
X2.1	,561	,107
X2.2	,265	,733
X2.3	,388	,521
X3.1	,275	,597
X3.2	,709	,195
X3.3	,505	,348
X4.1	,624	,277
X4.2	,612	,340
X4.3	,727	,289
X5.1	,816	,121
X5.2	,678	,327
X5.3	,332	,538

Rotation Method: Varimax with Kaiser Normalization.

next research due to its high internal consistency.

Two components which derived from its eigenvalues, then rotated and the values of factor loading shown on this table 6.

Based on rotation, it is found that there are three factors have lower factor loading than criteria, .30 (Hair, et.al., 2010, p.117), therefore, those factors should be omitted. Factor X.1.1 has 5 items, factor X.2.2. has 7 items and factor X.3.1 has 4 items, so there are totally 16 items should have been eliminated from specification table of NEP (see above table). For next research, it could be implemented 46 items of NEP which supported by 12 factors from 5 dimensions. As visual,

distribution of each factor could be seen from Figure 1.

DISCUSSIONS

Theoretically, the role of locus of control and knowledge as seen on this Figure 2. On this model, intention to act is assumed to be individual views, in this case, it could be environmental world view which hypothetically influence people responsible environment behavior (REB).

However, it has been found that only knowledge about ecosystem contributes significantly toward students NEP through first order correlation analysis.

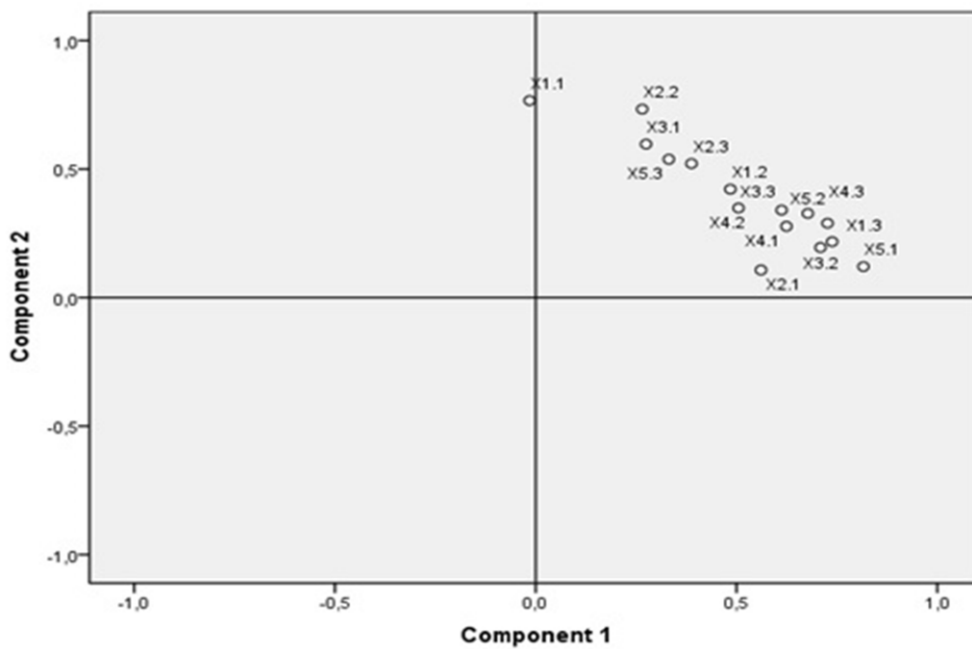


Figure 1. Component Plot in Rotated Space (2013)

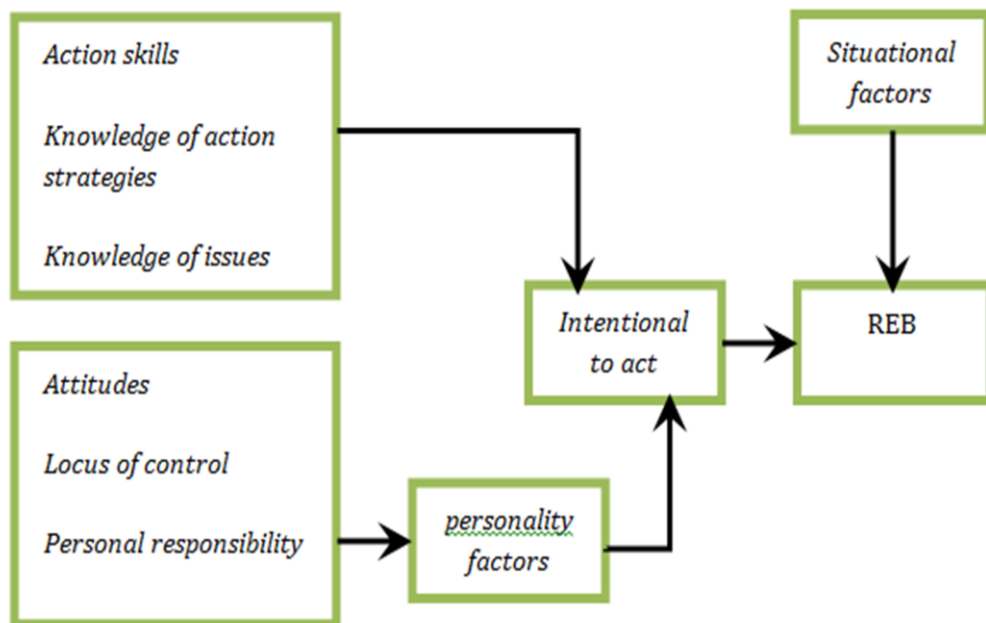


Figure 2. Model Hines (1986, in Blaikie, 1993), REB is responsible environment behavior.

Students locus of control is not a good predictor which is not in accordance to above model. That is why for future research of NEP instrument development, knowledge about ecosystem should be taken into consideration.

Since data 2014 indicated that none of items were dropped, mean that all items have high item validity, therefore it could be stated that sample size and number of items determine items quality in term of their validity and probably its reliability as well.

Related to its reliability, these findings proved that using data 2013 with $n = 362$ (62 items), NEP reliability is .90, and its reliability to become higher (.908) when all items used were valid (46 items) and sample size was 722. Compared to Waikato study (2013, p. 30), using 6 and 15 items, its reliability around .60s or even .40s, moreover, Dunlap, et.al. (2000) stated that "...reliability is respectable .83 (see research findings above). In this report, it was not found sample size used on those studies.

These findings support some studies and literatures which stated that number of items and sample size strongly determine instrument quality in term of its validity and reliability (Frankel & Wallen, 2012; Nitko, 2005).

But result of factor analysis showed different findings if number of items and sample size are discussed. Those do not have any influence on Eigen values and factor loadings. It much influenced by communality which indicates strong correlation among variables (items) and each factor.

Therefore, NEP instrument which consisting of 5 dimensions (based on Dunlap, et.al, 1978): (1) Limits to growth (13 items); (2) Anti-anthropocentrism (13 items); (3) Balance of nature (13 items); (4) Rejection of Exemptionalism (11 items) and (5) Eco-crisis (12 items) are empirically confirmed.

CONCLUSIONS

Based on research findings, it could be concluded that:

Firstly, NEP could only be explained by knowledge about ecosystem, therefore some statements could reflect students knowledge about ecosystem as indicators that they have framework of thought in term of environmental paradigm.

Secondly, Empirically, it has been proven that students NEP could be measured by factors that seem to be high in dimensionality as indicated by factors which have higher factors loading without rotation, in term of principal component analysis (PCA) with only one component for all factors due to bigger sample size at second stage study (2014).

Thirdly, Reducing number of factors could be happened again in next stage study (final stage in 2015),

depend on the value of factors loading with bigger number of sample, therefore NEP instrument would be consisted of less amount of items but have strong internal consistency which characterized by dimensionality, even though theoretically it has been derived from 5 dimensions that tend to be move from DSP to NEP.

Fourthly, NEP could be stand for New Ecological Paradigm (in Anderson, 2012, p. 261), instead of new environmental paradigm, due to the improvement of people world/environmental view or attitude toward the Earth where they live on, moving from anti-ecological to mid-ecological and finally to pro-ecological (in Waikato Report, 2013, p. 30). Moreover, New Environmental Paradigm was renamed New Ecological Paradigm (Dunlap, et.al., 2000, in Kopnina, 2011, p. 376).

Fifthly, Sustainable Development could be strengthened when most of us have positive and high NEP by decreasing people who DSP oriented.

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