# Causal Relationship Model of Environmental Education and Psychological Trait

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**Abstract:** *Environmental education and psychological trait play important roles for global citizen to take responsible for their behaviors change through inspiration of public consciousness in daily life activity. This might be an successful environmental behavioral change to decrease the greenhouse gases by raising awareness, adjusting attitude and belief, increasing skill and participation with practice in daily living to accomplish sustainable development. The populations will be undergraduate students of academic year 2011 of Mahasarakham University. The Multi-stage random sampling was used to collect the sample for 450 undergraduate students. The questionnaire was employed as instrument for data collecting. LISREL was used for model verification. Results illustrated that considering on structural model confirmatory factors of EE and TRAIT were able to explain the variation of endogenous factors of Inspiration of Public Consciousness (MIND) to caused Environmental Behaviors for Global Warming Alleviation (BEH) with 89.00 percents. Therefore, the equation 1, can be written as following:*

$$BEH = 0.32\ MIND + 0.29\ TRAIT + 0.75\ EE \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$
$$(R^2 = 0.89)$$

*Moreover, considering on structural model confirmatory factors of EE and TRAIT were able to explain the variation of endogenous factors of Inspiration of Public Consciousness (MIND) with 97.0 percents. Therefore, the equation 2, can be written as following:*

$$MIND = 0.67\ TRAIT + 0.58\ EE \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(2)$$
$$(R^2 = 0.97)$$

**Key Words:** *Causal Relationship Model / Environmental Education / Psychological Trait / Global Warming Alleviation*

## 1. Introduction

Over the world, global warming is accepted as critically environmental matters since the increasing in the average temperature of Earth's atmosphere and oceans is still rapidly persistent. This event is recognized by the international science academies from all the major industrialized countries. There was no objection by any global scientific organizations at national or international reputations. Principally, the majority of scientists specify that the warming in current decades has been caused first and primary by human being activities that have increased the quantity of greenhouse gases in the atmosphere such as deforestation, fossil fuel combustion and destroyed biodiversity in forest and ocean by over harvesting (United States National Academy of Sciences., 2008, National Research Council of USA., 2010, & Thiengkamol, 2011e).

Even though, there has been international mitigation effort for greenhouse gases such as the Kyoto Protocol. It searches to stabilize greenhouse gas concentration to prevent a "dangerous anthropogenic interference" (UNFCCC, 2005). However, at international level as of May 2010, 192 states members of the UNFCCC had ratified the protocol. The only members of the UNFCCC that were asked to sign the treaty but have not yet ratified it are the USA and Afghanistan (UNFCCC, 2011). This might indicated that if there was no real collaboration from every country in the world, particularly, the power country likes as USA does not act as good role model for other countries to ratify the protocol. It might be failure for greenhouse gases reduction to achieve global warming alleviation.

Presently, environmental information on climate change with global warming has become essential matter for general people who have been directly impacted by different disasters such as earth quake, flood, and drought. Additionally these have caused changing natural system, ecological system, biodiversity loss, new vector of disease born, and species migration, as a final point, it caused directly to human life quality. However, the environmental problem solving will be not successful if individual does not realize to take responsibility to participate seriously. From different studies of Thiengkamol and her colleagues, it was found that most the people have not enough knowledge and

understanding,  lack of consciousness, awareness, and attitude to practice proper behavior including realizing that they take very important parts to take responsibility for conservation of natural resources and environment, especially with public consciousness or public mind (Thiengkamol, 2011a, Thiengkamol, 2011b, Thiengkamol, 2011c, Thiengkamol, 2011g, Thiengkamol, 2011h, Thiengkamol, 2011i, Thiengkamol, 2012a, Thiengkamol, 2012b, Thiengkamol, 2012c, Jumrearnsan,  and Thiengkamol, 2012, Saenpakdee, and Thiengkamol, 2012, Sukserm, et al., 2012, Sukwat, et al., 2012, Wattanasaroch, et al., and Ruboon, et al., 2012).

The Tenth National Economic and Social Development Plan of Thailand (B.E. 2550-2554), it also included the participation of every sectors in Thai society and aimed to set Thai citizen as center of development in order to meet sustainable economic and society based on the moral and ethics for living and natural resources and environment conservation for  developing the better quality of life of Thai people in numerous aspects. This was in the line with the sustainable development principle which is in accordance to concept of conference of environment and development of United Nation since 1992 (Office of National Economic and Social Development Plan, 2010, WCED, 1987, Volker,  2007, Watkinson, 2009, &Thiengkamol, 2011e).

Considering on the intention of psychologists tried to understand on human behavior by developing a variety of concepts, theories and models with focal point on explanation how individual perceived and evaluated the stimulants before making decision to convey his behavior. On the other hand, study on human behavior, it can't be neglected the psychological trait and trait theorists are principally interested in the quantity of traits, which can be defined as habitual patterns of behavior, thought, and emotion together with psychological health and physical health which are inherited trait from parents. The various debates over that whether nature (genetic) or nurture (environment), or both contribute are significantly to our complete expressions (Kassin, 2003, & Pearson, 2006).

In accordance with this perspective, traits are relatively steady over time, differ across individuals, and these influence behavioral expressions. Conversely, in studying of human geography, it revealed that both physical and biological features are the stimulants to make people convey their behaviors in diverse approaches of place, surrounding people, and experience. These are unable to ignore since the human and environment are deeply and tightly associated to each other, while environment also can play a role as stimulant to cause human to carry out different activities. Hence, the human behavior was expressed by psychological trait and it also related to make a change of environmental behavior (Suwan, 2006). The ability of understanding about behavioral occurrence or expression of human, especially, psychological traits that might pilot to predict and control the undesirable behavior or promote and build the desirable behaviors for environmental conservation for global warming alleviation (Thiengkamol, 2012c).

Concerning to another essential factor, the inspiration of public consciousness or public mind also should not be neglected. Public mind or public consciousness was defined by different perceptions or considerations of people, however in Thai society gave various meaning such as National Research Council of Thailand giving definition of public mind that take notice and participate in the public issues with providing advantage to country with consciousness and holding the system of morality and ethics together with indignity for good action and emphasizing on being neat, economizing, and balance between human and nature.

 Additionally, Thiengkamol mentioned that public consciousness or public mind based on inspiration is occurred from insight of people and inspiration is different from motivation because inspiration needs no rewards. Inspiration of public consciousness or public mind, especially, for natural resources and environment conservation, one will not receive any reward, admiration or complement for their action to protect and conserve natural resources and environment. Inspiration might occur from appreciation in a person as role model or idle, events, situations, environment, media perceived such movies, book, magazine, and internet (Thiengkamol, 2009b, Thiengkamol, 2009c, Thiengkamol,  2011a,  Thiengkamol, 2011e, Thiengkamol, 2011i, and Thiengkamol, 2012c).

 It was obviously seen that there was few researches done on environmental behavior for global warming alleviation affecting by environmental education based on psychological trait covering physical health, psychological health, self-confidence, mercy and kindness, achievement motivation, and goal of life. Currently, it is very rarely and there is no research is holistically integrative done about environmental education when it compared with other aspects of relating factors affecting to environmental behaviors.

Therefore, this research was designed to study by covering all factors relating as mentioned above, it would be able to develop a model of environmental behaviors that are affected by environmental education and psychological traits based on inspiration of public consciousness.

## 2. Objective

The objective was to propose the causal relationship model of environmental education and psychological trait affecting to environmental behavior for global warming alleviation through inspiration of public consciousness.

## 3. Methodology

The research design was implemented in steps by step as follows:

The populations were 35,010 undergraduate students of the first semester in academic year 2011 of Mahasarakham University. The Multi-stage random sampling was employed to collect data with 450 students from different faculties of Mahasarakham University.

The research instrument was the questionnaire and it was used for data collection.

The content and structural validity were determined by Item Objective Congruent (IOC) with 5 experts in the aspects of environmental education, psychology, social science and social research methodology. The reliability was done by collecting the sample group from 50 undergraduate students of Rajabhat Mahasarakham University which is nearby Mahasarakham University. The reliability was determined by Cronbach's Alpha. The reliability of environmental education, psychological traits, and inspiration of public consciousness, environmental behaviors, and the whole questionnaire were 0.937, 0.838, 0.829, and 0.968 respectively.

The descriptive statistics used were frequency, percentage, mean and standard deviation. The inferential statistics used was LISREL by considering on Chi-Square value differs from zero with no statistical significant at .05 level or Chi-Square/df value with lesser or equal to 2, P-value with no statistical significant at .05 level and RMSEA (Root Mean Square Error Approximation) value with lesser than 0.05 including index level of model congruent value, GFI (Goodness of Fit Index) and index level of model congruent value, AGFI (Adjust Goodness of Fit Index) between 0.90-1.00.

## 4. Results

### 4.1 Results of Confirmatory factors of Exogenous Variables

Results of Confirmatory Factor Analysis of Exogenous Variables of Environmental Education (EE) and Psychological Trait affecting to environmental behaviors for global warming alleviation, were revealed as followings.

1) Confirmatory factors of EE had Bartlett's test of Sphericity of 995.457 statistically significant level (p< .01) and Kaiser–Mayer–Olkin Measure of Sampling Adequacy/MSA) of 0.809. This indicated that components of EE aspect had proper relationship at good level and it can be used for analysis of confirmatory factors as shown in picture 1 and table 1.
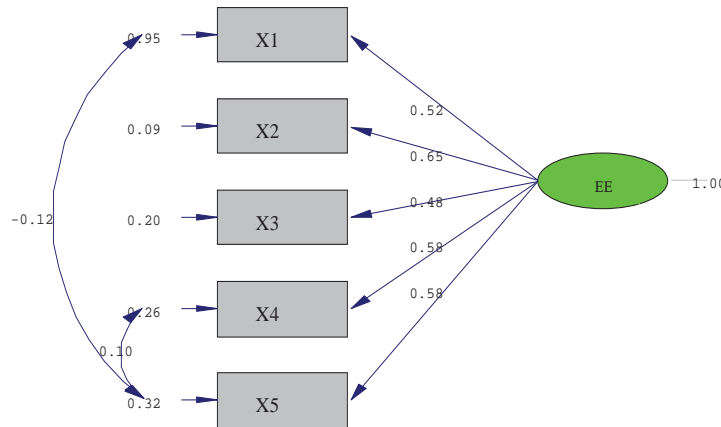


Chi-Square=3.30, df=3, P-value=0.34705, RMSEA=0.015

Picture 1: Model of Confirmatory factors of Environmental Education

Table 1 Results of Analysis of Confirmatory factors of Environmental Education

| Components of Environmental Education | Weight | SE | t | $R^2$ |
|---|---|---|---|---|
| X1 Knowledge and Understanding on Environment | 0.52 | 0.052 | 9.93** | 0.22 |
| X2  Attitude toward Environment | 0.65 | 0.029 | 22.84** | 0.82 |
| X3  Value for Environment | 0.48 | 0.028 | 17.03** | 0.53 |
| X4  Skill for Environmental Practice | 0.58 | 0.033 | 17.43** | 0.56 |
| X5  Participation to Environmental Activities | 0.58 | 0.036 | 16.24** | 0.51 |
| Chi-square = 3.30  df = 3  P = 0.34705 | | | | |
| GFI = 1.00  AGFI = 0.99  RMSEA = 0.015  RMR =0.010 | | | | |

** Statistically significant level of .01

From picture 1 and table 1, results of analysis of  confirmatory factors of EE from 5 observe variables were revealed that the model was congruent to empirical data by considering from 1）Goodness  of  Fit  Index (GFI) equaled to 1.00 and Adjust  Goodness  of  Fit  Index (AGFI)  equaled to 0.99  2）Root  Mean  Square  Error  of  Approximation (RMSEA) equaled to 0.015  (RMSEA < 0.05) and 3）Chi- Square value had no statistically significant at level of .01 and degree of freedom was lesser than or equaled to .05 ( $x^2 / df \leq 5.00$ ).

Considering on loading weight of observe variables in model, it was revealed that observe variables had loading weight with 0.48 to 0.65 and had covariate to model of Environmental Education with 22.00 to 82.00 percents.

2) Confirmatory Factor Analysis of Psychological Trait (TRAIT)

Confirmatory factors of EE had Bartlett's  test  of  Sphericity of 591.807    statistically significant level (p< .01) and Kaiser–Mayer–Olkin  Measure  of  Sampling  Adequacy/MSA) of 0.782.  This indicated that components of TRAIT aspect had proper relationship at good level and it can be used for analysis of confirmatory factors as shown in picture 2 and table 2.
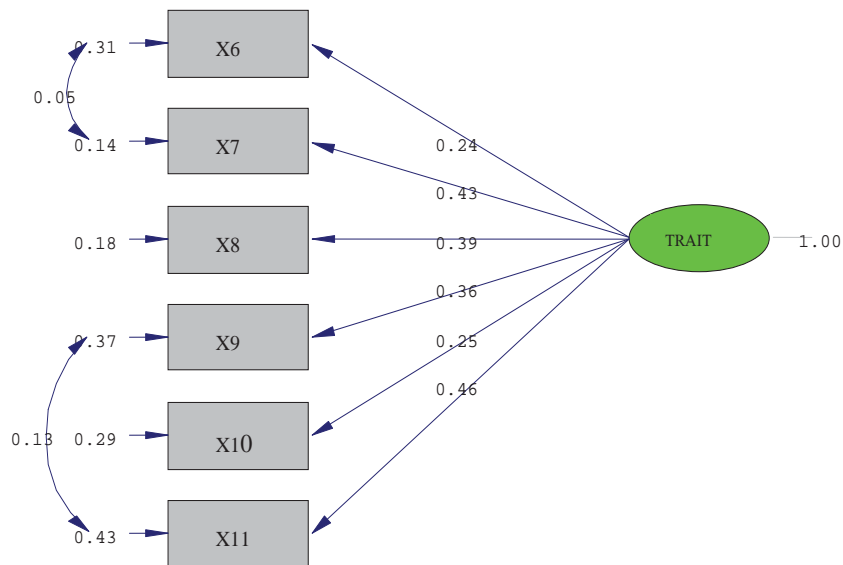


Chi-Square=10.20, df=7, P-value=0.17745, RMSEA=0.032

Picture 2: Model of Confirmatory factors of Psychological Trait

Table 2 Results of Analysis of Confirmatory factors of Psychological Trait

| Confirmatory factors of Psychological Trait | | Weight | SE | t | $R^2$ |
|---|---|---|---|---|---|
| X6 | Physical Health | 0.24 | 0.035 | 6.94** | 0.16 |
| X7 | Psychological Health | 0.43 | 0.028 | 15.14** | 0.57 |
| X8 | Self-Confidence | 0.39 | 0.029 | 13.71** | 0.46 |
| X9 | Mercy and Kindness | 0.36 | 0.037 | 9.71** | 0.25 |
| X10 | Achievement Motivation | 0.25 | 0.031 | 8.02** | 0.17 |
| X11 | Goal of Life | 0.46 | 0.040 | 11.45** | 0.34 |
| Chi-square = 10.20 df = 7 P = .17745 | | | | | |
| GFI = 0.99 AGFI = 0.98 RMSEA = 0.032 RMR = .0093 | | | | | |

** Statistically significant level of .01

From picture 2 and table 2, results of analysis of confirmatory factors of TRAIT from 6 observe variables were revealed that the model was congruent to empirical data by considering from 1) Goodness of Fit Index (GFI) equaled to 0.99 and Adjust Goodness of Fit Index (AGFI) equaled to 0.98 2) Root Mean Square Error of Approximation (RMSEA) equaled to 0.032 (RMSEA < 0.05) and 3) Chi- Square value had no statistically significant at level of .01 and degree of freedom was lesser than or equaled to .05 ( $x^2 / df \leq 5.00$ ).

Considering on loading weight of observe variables in model, it was revealed that observe variables had loading weight with 0.24 to 0.46 and had covariate to model of Psychological Trait with 16.00 to 57.00 percents.

*Results of Confirmatory Factor Analysis of Endogenous Variables*

Results of Confirmatory Factor Analysis of Endogenous Variables of Inspiration of Public Consciousness influencing to environmental behaviors for global warming alleviation, was revealed as followings.

Confirmatory Factor Analysis of Endogenous Variables of Inspiration of Public Consciousness (MIND)
Confirmatory Factor of Inspiration of Public Consciousness (MIND) had Bartlett's test of Sphericity of 579.893 statistically significant level (p< .01) and Kaiser–Mayer–Olkin Measure of Sampling Adequacy/MSA) of 0.656. This indicated that components of EE aspect had proper relationship at good level and it can be used for analysis of confirmatory factors as shown in picture 3 and table 3.
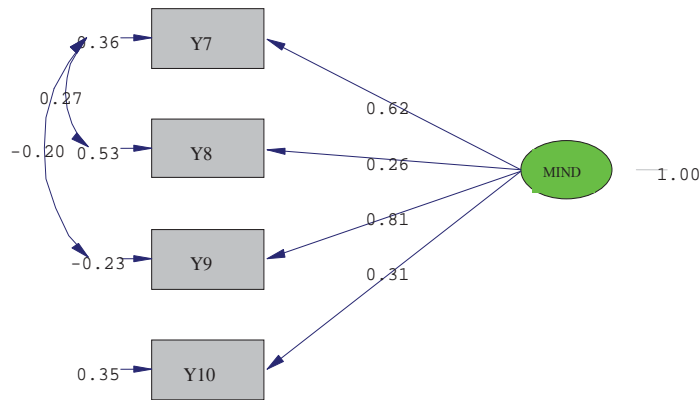


Chi-Square=0.00, df=0, P-value=1.00000, RMSEA=0.000

Picture 3: Model of Confirmatory factor of Inspiration of Public Consciousness

Table 3 Results of Analysis of Confirmatory factors of Inspiration of Public Consciousness

| Confirmatory factors of Inspiration of Public Consciousness | | Weight | SE | t | $R^2$ |
|---|---|---|---|---|---|
| Y7 | Person as Role Model | 0.62 | 0.074 | 8.32** | 0.51 |
| Y8 | Impressive Event | 0.26 | 0.047 | 5.54** | 0.11 |
| Y9 | Impressive Environment | 0.81 | 0.097 | 8.34** | 1.00 |
| Y10 | Public Mind Performance | 0.31 | 0.047 | 6.54** | 0.21 |
| Chi-square = 0.00  df = 0  P = 1.0000 | | | | | |
| GFI = 1.00  AGFI = 1.00  RMSEA = 0.000  RMR = .000 | | | | | |

      ** Statistically significant level of .01

From picture 3 and table 3, results of analysis of confirmatory factors of MIND from 4 observe variables was revealed that the model was congruent to empirical data by considering from 1) Goodness of Fit Index (GFI) equaled to 1.00 and Adjust Goodness of Fit Index (AGFI) equaled to 1.00 2) Root Mean Square Error of Approximation (RMSEA) equaled to 0.000 (RMSEA < 0.05) and 3) Chi- Square value had no statistically significant at level of .01 and degree of freedom was lesser than or equaled to .05 and $x^2 / df \leq 5.00$.

      Considering on loading weight of observe variables in model, it was revealed that observe variables had loading weight with 0.26 to 0.81 and had covariate to model of Inspiration of Public Consciousness with 11.00 to 100.00 percents.

Confirmatory Factor Analysis of Endogenous Variables of Environmental Behaviors for Global Warming Alleviation (BEH)
      Confirmatory Factor of Environmental Behaviors for Global Warming Alleviation (BEH) had Bartlett's test of Sphericity of 834.218 statistically significant level (p< .01) and Kaiser–Mayer–Olkin Measure of Sampling Adequacy/MSA) of 0.832. This indicated that components of BEH aspect had proper relationship at good level and it can be used for analysis of confirmatory factors as shown in picture 4 and table 4.
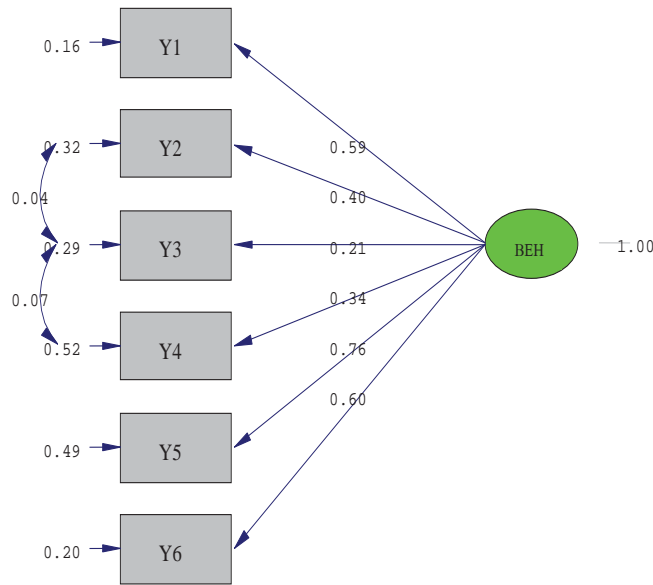


Chi-Square=11.08, df=7, P-value=0.13517, RMSEA=0.036

Picture 4: Model of Confirmatory factors of Environmental Behaviors for Global Warming Alleviation (BEH)

Table 4 Results of Analysis of Confirmatory factors of Environmental Behaviors for Global Warming Alleviation

| Confirmatory factors of Environmental Behaviors for Global Warming Alleviation | Weight | SE | t | $R^2$ |
|---|---|---|---|---|
| Y1   Consumption Behavior | 0.59 | 0.029 | 19.95** | 0.69 |
| Y2   Energy Conservation | 0.40 | 0.032 | 12.67** | 0.34 |
| Y3   Waste Management | 0.21 | 0.028 | 7.41** | 0.13 |
| Y4   Traveling Behavior | 0.34 | 0.039 | 8.81** | 0.18 |
| Y5   Recycling Behavior | 0.76 | 0.044 | 17.01** | 0.54 |
| Y6   Knowledge Transferring and Supporting for Environmental Conservation | 0.60 | 0.031 | 18.96** | 0.64 |
| Chi-square = 11.08  df = 7  P = 0.13517 | | | | |
| GFI = 0.99  AGFI = 0.98  RMSEA = 0.000  RMR = 0.036 | | | | |

       ** Statistically significant level of .01

From picture 4 and table 4, results of analysis of confirmatory factors of BEH from 6 observe variables were revealed that the model was congruent to empirical data by considering from 1) Goodness of Fit Index (GFI) equaled to 0.99 and Adjust Goodness of Fit Index (AGFI) equaled to 0.98  2) Root Mean Square Error of Approximation (RMSEA) equaled to 0.000  (RMSEA < 0.05) and 3) Chi- Square value had no statistically significant at level of .01 and degree of freedom was lesser than or equaled to .05. $\chi^2 / df \leq 5.00$ .

Considering on loading weight of observe variables in model, it was revealed that observe variables had loading weight with 0.21 to 0.76 and had covariate to model of Environmental Behaviors for Global Warming Alleviation with 13.00 to 69.00 percents.

*4.3 Results of Effect among Variables in Model in Terms of Direct Effect*

1) Confirmatory factors of Environmental Education (EE) had direct effect to Inspiration of Public Consciousness (MIND) and Environmental Behaviors for Global Warming Alleviation (BEH) with statistically significant at level of .01 with effect of 0.58 and 0.75.  Moreover, confirmatory factors in aspect of Environmental Education (EE) had indirect effect to Environmental Behaviors for Global Warming Alleviation (BEH) with statistically significant at level of .01 with effect of 0.19.

2) Confirmatory factors of Psychological Trait (TRAIT) had direct effect to Inspiration of Public Consciousness (MIND) and Environmental Behaviors for Global Warming Alleviation (BEH) with statistically significant at level of .01 with effect of 0.67 and 0.29.  Moreover, confirmatory factors in aspect of Psychological Trait (TRAIT) had indirect effect to Environmental Behaviors for Global Warming Alleviation (BEH) with statistically significant at level of .01 with effect of 0.21.

Confirmatory factors of Inspiration of Public Consciousness (MIND) had direct effect to Environmental Behaviors for Global Warming Alleviation (BEH) with statistically significant at level of .01 with effect of 0.32.

Considering on structural model confirmatory factors of EE and TRAIT were able to explain the variation of endogenous factors of Inspiration of Public Consciousness (MIND) to caused Environmental Behaviors for Global Warming Alleviation (BEH) with 89.0 percents. Therefore, the equation 1, can be written as following.

$$BEH = 0.32\ MIND + 0.29\ TRAIT + 0.75\ EE \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$
$$(R^2 = 0.89)$$

Equation (1) factors that had the most effect to Environmental Behaviors for Global Warming Alleviation (BEH) was Environmental Education (EE), subsequences were Inspiration of Public Consciousness (MIND) and Psychological Trait (TRAIT) and these were able to explained the variation of Environmental Behaviors for Global Warming Alleviation (BEH) with 89.0 percents.

Moreover, considering on structural model confirmatory factors of EE and TRAIT were able to explain the variation of endogenous factors of Inspiration of Public Consciousness (MIND) with 97.0 percents. Therefore, the equation 2, can be written as following.

$$MIND = 0.67\ TRAIT + 0.58\ EE \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(2)$$
$$(R^2 = 0.97)$$

Equation (2) factors that had the most effect to Inspiration of Public Consciousness (MIND) was Environmental Education (EE), subsequences was Psychological Trait (TRAIT) and these were able to explained the variation of Environmental Inspiration of Public Consciousness with 97.0 percents.
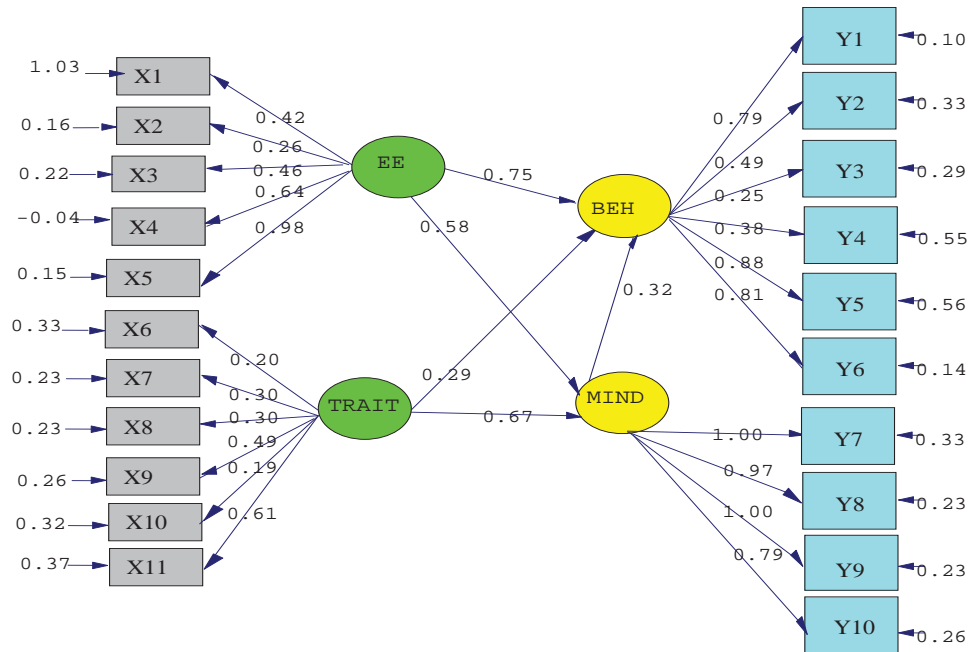


Chi-Square=235.78, df=196, P-value=0.210, RMSEA=0.034

Picture 5: Model of Direct and Indirect Effect of EE TRAIT through MIND Affecting to BEH

5. Discussion

The findings indicated that environmental education had direct affecting to inspiration of public consciousness and environmental consumption behavior for global warming alleviation with highly with statistically significant at level of .01 with effect of 0.58 and 0.75. Additionally, Moreover, when considering on weight of loading of observe variables of Skill for Environmental Practice (X4), and Participation to Environmental Activities (X5) was congruent to different studies of Thiengkamol, N. (2004, 2005a, 2005b, 2010b, 2011a, 2011b, & 2011c) that the results illustrated that the participants of Participatory Appreciation Influence Control (PAIC) training process with the integration of focus group discussion and brain storming would perform better environmental behaviors whether consumption behavior, energy consumption, recycling behavior, traveling behavior and knowledge transferring and supporting for environmental conservation after they had real practice via different activity participation for environmental conservation. Nevertheless, confirmatory factors of Psychological Trait (TRAIT) had direct effect to Inspiration of Public Consciousness (MIND) and Environmental Behaviors for Global Warming Alleviation (BEH) with statistically significant at level of .01 with effect of 0.67 and 0.29. This result is congruent to the concept of psychologists about psychological trait also an important factor that affected to mind and behavior of people and research of Thiengkamol, (2012c).

It might be concluded that environmental education determined by observe variables of Knowledge and Understanding on Environment (X1), Attitude toward Environment (X2), Value for Environment (X3), Skill for Environmental practice (X4), and Participation to Environmental Activity (X5) and Psychological Trait (TRAIT) composing of Physical Health (X6), Psychological Health (X7), Self-Confidence (X8), Mercy and Kindness (X9), Achievement Motivation (X10), and Goal of Life (X11) affecting to Behavior for Global Warming Alleviation (BEH) covering of

Consumption behavior (Y1), Energy conservation (Y2), Waste disposal (Y3), Traveling behavior  (Y4), Recycling behavior (Y5), and Knowledge transferring and supporting for environmental conservation (Y6).

The exogenous factors of Environmental Education (EE) and Psychological Trait were able to explain the variation of endogenous factors of Inspiration of Public Consciousness (MIND) to caused Environmental Behaviors for Global Warming Alleviation  (BEH) with 89.0 percents and the variation of endogenous factor of Inspiration of Public Consciousness (MIND) with 97.0 percents. The model of EE and TRAIT affecting to BEH through Inspiration of Public Consciousness was verified the proposed model was fitted with all observe variables according to criteria of Chi-Square value differs from zero with no statistical significant at .05 level or Chi-Square/df  value with lesser or equal to 2, P-value with no statistical significant at .05 level and RMSEA (Root Mean Square  Error Approximation) value with lesser than 0.05 including index level of model congruent value,  GFI (Goodness of Fit Index) and index level of model congruent value, AGFI (Adjust Goodness of Fit Index) between 0.90-1.00.

Therefore, it might be concluded that environmental education and psychological trait play very important roles to create the environmental behavior of consumption behavior, energy conservation, waste management, traveling behavior, recycling behavior , and knowledge transferring and supporting for environmental conservation, therefore environmental education should introduced by integration in every subjects in the school. Additionally, inspiration of public consciousness in aspects of person as role model, impressive event, impressive environment, and public mind performance should be paid attentions, particularly, in aspect of role model, the parents and teacher or even though movie star or political man should act as role model and express their public consciousness to inspire their children, students, and young generations. These results were congruent to concepts proposed by Thiengkamol (2009b, 2009c, & 2011e) and researches of Thiengkamol, (2012c) and Jumrearnsan, & Thiengkamol, (2012).

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