Comparative Analysis of Adult and Adolescent Environmental Awareness and Intervention of Adolescent Environmental Awareness

Zhengxia Long¹,², Shuai Wang¹,², Xiaoying Gu³, Yan Sun¹,², Jiawen Yu⁴ and Jinhua Yang⁴

¹Key Laboratory of Behavioral Science, Institute of Psychology, Chinese Academy of Sciences, Beijing, 100101, China
²Department of Psychology, University of Chinese Academy of Sciences, Beijing, 100049, China
³Department of Psychology, Beijing Normal University, Beijing, 100875, China
⁴Teachers’ College of Beijing Union University, Beijing, 100011, China

Corresponding author’s e-mail: suny@psych.ac.cn

Abstract. This study investigated the contrast between the environmental awareness of adults and adolescents, which explained an intervention on the environmental awareness of adolescents. Questionnaire survey method was adopted. T test and variance analysis were used to obtain the results. In addition, relevant sample T test was conducted for the first and second post-test results of the experimental group to verify the durability of environmental education effect. Result shows that: (1) the environmental awareness of adults was slightly higher than that of adolescents; (2) short-term environmental education played an obvious role in improving young people’s environmental awareness in a short time. This study updated the conclusion that the environmental awareness of teenagers was higher than that of adults, indicating the achievement of environmental education in China over the past 20 years. It can be also concluded that the short-term environmental education had a certain effect on improving the environmental awareness of youth, but it couldn’t last long. Short-term environmental education can be regarded as a supplement in present environmental education curriculum. Moreover, environmental education should be continuously.

1. Introduction
The environment is an important issue concerning the happiness and economic development of people all over the world[1]. “Environmental awareness” was first put forward at the second environmental protection conference held in China in 1983[2]. The current international definition of environmental awareness is primarily based on the definition proposed by the Tbilisi Intergovernmental Environmental Education Conference in 1977[3-4]. Tan et al. [5] released the Environmental Awareness Questionnaire for College Students in 2002, which made a specific definition of environmental awareness. Previous studies have shown that public environmental awareness is influenced by age, education and other factors [6-8]. Wei et al. [2] found a negative correlation between age and environmental awareness. In 1999, the national survey report on public environmental awareness in China[8] reported that the public environmental awareness of teenagers was higher than that of adults.
Environmental awareness was well defined at an international conference[10]. China's first environmental protection conference was held in 1973, marking that China's environmental education has entered a new period[10]. Primary school students' environmental education is mainly carried out through discipline infiltration. There existed some problems such as the lack of teaching materials, the defective practice system, the lack of teachers and failure to effectively implement, etc. There is no doubt that it is an urgent problem to improve the environmental education of primary school students[10-12]. Most previous studies focused on the comparative analysis on environmental awareness between Chinese and foreigner[12-14], primary and secondary students[15], normal and non-normal college students[16]. This study is based on Piaget's theory of cognitive development stage and Ausubel's theory of meaningful learning [17-19]. Through the comparative analysis of environmental awareness among 192 adults and 180 fourth-grade pupils, the difference between the environmental awareness of adults and adolescents is discussed. Furthermore, intervene in the environmental awareness of primary students is studied through short-term education.

2. Hypotheses and methods

2.1. Variables and hypotheses

2.1.1. Environmental awareness. The environmental awareness questionnaire compiled by Tan et al. [5] is adopted. The environmental awareness is divided into four dimensions:

- Environmental science knowledge: the knowledge and understanding of the environment.
- Environmental philosophical awareness: the cognition of the relationship between human and nature.
- Environmental ideology awareness: the understanding of environmental policies and related laws.
- Environmental ethics awareness: the moral level of environmental protection.

Based on the current research status of environmental awareness, the following hypothesis is proposed: H1a: adults have higher environmental awareness than adolescents.

2.1.2. Environmental education. It is the process of recognizing value and clarifying concepts, with the aim of developing the necessary skills and attitudes to understand and appreciate the interrelationships between human, cultural and biophysical environments, and to generate environmental practices[19]. The following hypothesis is proposed: H2a: Short-term environmental education for adolescents will effectively improve their environmental awareness.

2.2. Questionnaire survey

For adult group (over 18 years old), online questionnaire survey method was adopted and 193 questionnaires were obtained. 192 of them were valid (including 87 males and 105 females). For the adolescent group (aged 8-11), paper questionnaires were adopted. The results were collected in three times. Totally 180 valid questionnaires were obtained (experimental group: 45 males and 39 females; control group: 56 males and 40 females).

2.3. Experimental design

2.3.1. Experimental material. Zeng[18] found that for primary students, watching movies is the third favorite course of environmental education (37.9%). Video is easy for children to understand. Therefore, video teaching is adopted in this study to intervene environmental education.

2.3.2. Experimental procedures. The 2×2 mixed experiment design was adopted. The inter-subject variable was whether the students received intervention education of environmental awareness. The internal variable was the variance of the questionnaire scores among tests in different time. The
questionnaire was reset and the reliability and validity were tested. In this study, 235 primary students were tested and 225 questionnaires were collected. 180 of them were valid. There is a pre-test before intervention and the smaller the score, the stronger the environmental awareness. In experimental group (N=84), a 40-minute environmental education class was taken every week, while different environmental protection science video was watched every day for five weeks. There is no control in control group. After five weeks, the 180 testers were tested again and the post-test scores were obtained. Two months later, testers in experimental group were tested the third time to get the final-test score. After that, experimental data were collected and inputted into SPSS22. After relevant analysis, statistical results were obtained. For all outcomes, the smaller the score, the higher the environmental awareness.

3. Results

3.1. Reliability and validity test of the questionnaire
The reliability of the environmental awareness questionnaire in adult group (Cronbach $\alpha = 0.884$) and adolescent group (Cronbach $\alpha = 0.822$) were both fine.

3.2. Comparative analysis of environmental awareness between two groups
Independent sample T-test on environmental awareness was conducted in the adult group and the adolescent group, as shown in Table 1. The results shows that the environmental awareness of the adult group ($M=2.01, SD=0.31$) was slightly higher than that of the adolescent group ($M=2.32, SD=0.31$), with a significant difference $t(370)=-9.477, p<0.001$, which supported the H1a hypothesis. However, the adults are from different cities in China, while the adolescents are from the fourth grade pupils in Beijing. In order to avoid regional errors, results from 77 adults in Beijing and from adolescents were tested with an independent sample t-test, as shown in Table 2. It shows that the environmental awareness of the adult group ($M=2.04, SD=0.31$) was still slightly higher than that of the adolescent group ($M=2.32, SD=0.31$), with a significant difference $t(255)=-6.557, p<0.001$. So, the comparison of data from adult group in Beijing and from adolescents are consistent with the comparison results of national adults and adolescents, indicating the validity of the results.

| Table 1. Environmental awareness of adults compared with adolescents ($M \pm SD$). |
|-----------------------------------------------|
| Adult group (n=192) | Adolescent group (n=180) | $t$ | $p$ | df |
| 2.01 $\pm$ 0.31   | 2.32 $\pm$ 0.31          | -9.477 | .000 | 370 |

| Table 2. Environmental awareness of adults in Beijing compared with adolescents ($M \pm SD$). |
|-----------------------------------------------|
| Beijing adult group (n=77) | Adolescent group (n=180) | $t$ | $p$ | df |
| 2.04 $\pm$ 0.31   | 2.32 $\pm$ 0.31          | -6.557 | .000 | 255 |

3.3. Analysis of environmental awareness intervention in the adolescent group

3.3.1. Interaction between pro-test and post-test and between experimental types. Two-factor analysis of variance was performed with the pro-test and post-test of environmental awareness as the internal variable and the experimental type as the inter-variable. The mean and standard deviation of environmental awareness in pro-test and post-test are shown in Table 3. Data from experimental group and control group are both presented. It indicates that the main effect of environmental awareness pro-test and post-test is significant, with $F (1, 178) = 233.512, p<0.001, \eta^2 = 0.567$. The mean environmental awareness of post-test ($M=2.00$) is obviously higher than that of pro-test ($M=2.32$). The main effect of experimental types is also significant, as $F (1, 178) = 6.675, p<0.05, \eta^2 = 0.036$. It can be stated that environmental awareness in experimental group ($M=2.10$) is significantly higher than
control group \((M=2.21)\). The interactions between them is significant, as \(F(1,178)=103.528, p<0.001, \eta^2 = 0.368\). This result supports the hypotheses H2a. The simple effect analysis shows that for the experimental group, the mean environmental awareness of post-test \((M=1.83)\) is significantly higher than that of pre-test \((M=2.37)\), with \(F(1,178)=303.753, p<0.001, \eta^2 = 0.631\). Similarly, in the control group, the mean environmental awareness of post-test \((M=2.16)\) is also higher than that of pre-test \((M=2.27)\), with \(F(1,178)=13.97, p<0.001, \eta^2 = 0.631\). The slope of experimental group shown in figure 1 is lower, indicating that the interaction between the experimental type and the environmental awareness pro-test and post-test is significant \((p<0.01)\). The post-test environmental awareness is obviously lower than the pro-test. Although the score in control group drops in post-test, the slope of it is not as low as experimental group. The contrast between post-test and pro-test is distinct. In general, the environmental awareness of the experimental group and the control group both increased, while the increment of environmental awareness in experimental group is more significant than the control group after environmental education.

Table 3. The mean and standard deviation of environmental awareness in pro-test and post-test.

|                     | Experimental group \((N=84)\) | Control group \((N=96)\) |
|---------------------|-------------------------------|--------------------------|
|                     | \(M\) | \(SD\) | \(M\) | \(SD\) |
| Pro-test            | 2.37 | 0.34  | 2.27 | 0.28  |
| Post-test           | 1.83 | 0.33  | 2.16 | 0.31  |

3.3.2. Post-test and final test environmental awareness score analysis of the experimental group. To test the maintenance of the effect of environmental education intervention in experimental group, the T-test of the relevant samples was carried out between the post-test and the final test scores of the experimental group. The results were as follows: After two months, the experimental group environmental awareness of final test \((M=2.08, SD=0.34)\) was reduced compared to the post-test \((M=1.83, SD=0.33)\). The reduction was significant, with \(t(83)=-4.72, p<0.001\).

4. Conclusion

Based on the analysis of the data, the main conclusions of this study are as follows:

- Adults have higher environmental awareness than adolescents. It was inconsistent with previous studies\([2][8]\). On one hand, the environmental education was strengthened in China during last 20 years as times changed, hence, the environmental awareness of adults has already been improved; On the other hand, the environmental education in some schools appeared a mere formality. Environmental awareness of some students were not high.
Environmental awareness can be significantly improved through environmental education. Moreover, there was a significant interaction between pre-test and pro-test of environmental awareness and experimental types. Moreover, the results of short-term environmental education do not last long and can be used as a supplement to the systematic environmental education.

References
[1] UNESCO. (1972) The Stockholm Declaration. https://www.britannica.com/topic/Stockholm-Declaration.
[2] Wei, Y., Fan, Z.J., Sun, L., Liu, G.J. (2017) On an Analysis of Current Status and Influence Factors of Public Awareness on Environmental Protection in China. Studies on Science Popularization., 12(3): 33-38.
[3] Liu, B.R. (2003) Environmental education in primary and secondary schools under the framework of sustainable development. Liaoning Normal University.
[4] UNESCO, P. (1978). Intergovernmental conference on environmental education. Final Report in: Tbilissi (USRR). Paris (France).
[5] Tan, Q.B., Zhang, Y., Xu Y.C., Zhang W.J. (2002) Inventory's construction about the students' environmental awareness and environmental action. Journal of Xiangtan Normal University (Natural Science Edition), 24(4): 107-110.
[6] Eilam, E., Trop, T. (2014) Factors influencing adults’ environmental attitudes and behaviors and the role of environmental schools in influencing their communities. Education and Urban Society, 46(2): 234-263.
[7] Maurer, M., Bogner, F. X. (2019) How freshmen perceive Environmental Education (EE) and Education for Sustainable Development (ESD). PLoS one, 14(1): e0208910.
[8] State Environmental Protection Administration. (1999) Report of the national public environmental awareness survey. People's Tribune. 7: 21-23.
[9] IUCN. (1970) International working meeting on environmental education in the school curriculum. https://files.eric.ed.gov/fulltext/ED045490.pdf.
[10] Hua, Q.Q. (2019) The Present Situation and Countermeasures of Environmental Education in Primary and Middle Schools. Environmental education., 219(04): 53-55.
[11] Sheng, Y. (2014) On the environmental education of primary school students. Modern Education Science., 5: 45-46.
[12] Wang, J. (2003) An Initial Study of Experience and Inspiration of Environmental Education about Elementary and High Schools in Us. Doctoral dissertation, Southwest Normal University.
[13] Chen, J.Y. (2005) A Comparative Study on Environmental Education and Environmental Awareness and Behavior of College- students between China and Japan. Forum on contemporary education., 07: 131-132.
[14] Zhang, Y.P., Guo, L.X. (1999) Comparison between the Environmental Consciousness of Polish and Chinese College- students. Yinshan Academic Journal (Social Science Edition) 12(3): 110-114.
[15] Wang, J.L., He, Y.Y., He, X., Jiao, Y.M., Wang, X.F., Li, Y. (2001) Comparative Analysis of Environmental Awareness of Primary and Middle School Students in Kunming. YUNNAN ENVIRONMENTAL SCIENCE, 20(1): 20-22.
[16] Liang, Y., Li, Y.P., Xiao, J., Li, K., Yu, Q. (2014) Investigation and Comparative Analysis of Environmental Awareness of College Students in Normal Universities. Science and Technology of West China 6: 74-75.
[17] Gao, Y. (2018) The Enlightenment of the Theory of Cognitive Development Stage on Educational Practice. Mental Health Education In Primary and Secondary School, 358(11): 17-19.
[18] Zeng, G.M. (2012) The Research of Pupil’s Preference and Satisfaction on the Environmental education project - Environmental education base in Yuhua district of Changsha city as an example. Doctoral dissertation in: Central South University of Forestry and Technology.
[19] Zhao, Y. (2017) Research on Intervention of Online Self-Regulated Learning of K12 Teachers from the Perspective of Learning Analytics. Doctoral dissertation in: Northeast Normal University.