

An Experimental Study on the Effects of Environmental Education in China

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Abstract: In recent years, collaborative governance has been used as an innovative approach by government, NGOs, and business for consensus building in the process of policy making and service delivery (Ansell and Gash, 2008, Brown et al., 2006). However, little has been written on the psychological aspects of collaborative governance. What are the antecedents of collaborative decisions? To what extent and in what ways can NGOs' advocacy impact community residents' opinions? For example, in the field of environmental protection, the conflict between environmental conservation and economic development has been a key issue, which presents a fundamental challenge to the formation of collaborative environmental governance. Environmental NGOs have used educational approaches to influence key stakeholders; but it remains an intriguing issue as in what ways and to what extent their educational efforts have impacted these stakeholders. To answer these questions, we explored the attitudinal antecedents of collaborative governance by conducting an experimental study on the effects of environmental education in rural China. Specifically, we focus on two types of environmental education programs: Environmental Education (EE) and Education for Sustainability (ESD). While EE focuses on providing scientific education in raising environmental awareness, ESD incorporates economic, social, and environmental factors to bring about solutions to achieve sustainability. We found that ESD is more effective in stimulating attitudinal changes towards environmental conservation, and EE is more powerful in generating a hidden effect: the anti-development attitude, among participants in China. We also studied the moderating effects of economic pressure, place attachment, and we found that being poor and being nonlocal may strengthen a participant's likelihood to develop attitudinal changes towards economic development. Overall, our research contributes to a better understanding of the psychological aspects of collaborative governance, and it calls a more balanced approach in environmental education.

INTRODUCTION

For the past decades, it is apparent that living quality is becoming a serious problem due to degradation, climate change, and deforestation. To implement an effective conservation plan, government plays a very important role ensure that policy are aligned and followed through with different stakeholder's interests. Collaborative governance has been used as an innovative approach by the government, NGOs, and business for consensus building in the process of policymaking and service delivery (Ansell and Gash, 2008, Brown et al., 2006). However, little has been written on the psychological aspects of collaborative governance. What are the antecedents of collaborative decisions? To what extent and in what ways can NGOs' advocacy impact community residents' opinions? For example, in the field of environmental protection, the conflict between environmental conservation and economic development has been a key issue, which presents a fundamental challenge to the formation of collaborative environmental governance.

Based on Agenda 21, chapter 36 of the East Summit, Government and NGOs have been using two types of environmental education interventions, namely Environmental Education (EE) and Education for Sustainability (ESD), trying to foster a pro-environmental attitude formation among stakeholders especially students in different countries. EE focuses on providing scientific education in raising environmental awareness, while ESD incorporates economic, social, and environmental factors to bring about solutions to achieve sustainability. However,

debates on these two education approaches are that *EE* emphasizes the scientific aspect of environmental conservation and the program may involve information on how human impacts, including the need-based activities such as farming, and activities that fulfill materialist desires, such as recreational hunting and gold mining, has been harmful to resource conservation. Therefore, general perception of *EE* is that it is a one-sided radical approach to educate the public about conservation (Hungerford, et al., 1985). On the other hand, *ESD* is a more comprehensive curriculum incorporates *EE* with a problem-to-solution package for sustainability development, it is considered as a balanced education approaches to promote sustainable development (McKeown & Hopkins, 2007; Sarabhai, 2011, Toili, 1996). However, to the best of my knowledge, there has so far been no empirical research investigating into the impacts and effectiveness of *EE* and *ESD* to in terms of its effectiveness on altering students' attitudinal change.

By acknowledging the importance of both ecological conservation and global poverty alleviation, this research explored the attitudinal antecedents of collaborative governance by conducting an experimental study on the effects of environmental education in rural China, by closing the gaps of (1) the lack of empirical research to identify and to compare *EE* against *ESD*; (2) *EE* and *ESD* are said to have been designed to deal with sustainability development but the previous environmental education literature only focuses on environmental conservation without properly addressing economic development; (3) the lack of empirical research to address the contention within sustainability development i.e. environmental conservation vs. economic development.

LITERATURE REVIEW AND HYPOTHESES

The theoretical framework of this research is based on Hovland's learning model (1951), and other research frameworks of *EE* (Cottrell, 2003; Hwang et al., 2000; McFarlane, 2006), *ESD* (Anderberg et al., 2009; Haigh, 2006), and theories of sustainability development (Wunder, 2000). The objectives of this research are to understand the contention within sustainability development by examining its relationship with the two education interventions, *EE* and *ESD*. To cover what is neglected in the prior research, the economic dimension, i.e. the problematic areas causing conflicts with respect to sustainability.

Attitude towards conservation

Hypothesis 1 verifies the impacts of *EE* and *ESD* on attitudes towards environmental conservation in China. It is generally agreed that *EE* helps people understand how scarce our resources have become, and that it is important to preserve ecological habitats to help maintain a balanced ecological system (Bruyere et al., 2012; Rosalino & Rosalino, 2012). Much of the literature on *EE* concludes that *EE* not only increases people's environmental awareness and their knowledge of the importance of natural resources and habitats, but also of the ways human beings have been abusing them, as well as of how we should protect them (Contento, Randell, & Basch, 2002; Cox et al., 1998; Cromley & Azevedo, 2007; McKenzie et al., 2004). Taking this research for example, when the panda's habitats are introduced, students immediately realize the damage human development has caused on their

living environment, which have reduced the local panda population. The information from the education intervention will help students develop empathy towards the pandas. Thus this awareness from their learning of human impacts will stimulate an increase of pro-environmental attitude that is outlined in prior studies -- a heightened environmental awareness leads to a stronger pro-environmental attitude (Bamberg & Moser, 2007; Cottrell, 2003; Hwang et al., 2000; McFarlane, 2006).

H1 (a): EE positively influences Individuals' attitudes toward environmental conservation.

Adopted from the Anderberg (2009) model, *ESD* incorporates *EE* and sustainability development. It is reasonable to believe that when the same message is delivered to the students in the *ESD* group, the education program will increase awareness and positive attitudes towards sustainability development, including both environmental conservation and economic development across a wide spectrum of settings (Pavlou & Fygenson, 2006).

H1 (b): ESD positively influences individuals' attitudes towards environmental conservation.

Attitudes towards development

Hypothesis 2 examines the flip-side effect of education on economic development as a result of *EE* and *ESD*. Based on Halpenny (2010) and Raymond's (2011) findings, environmental awareness induces a side effect of developing guilty

feelings for one's failure to protect the living environment. Bamberg & Moser's (2007) research also supports the finding that feelings of guilt increase people's environmental attitudes (Videras et al., 2011). In this research, when students learn the fact that human development is a predominant cause of the near extinction of the pandas, they will realize the negative effects of economic development. To this end, *EE* induces the students' guilty feelings such that they will develop positive attitudes towards conservation. Bringing the contention between environmental attitudes and economic development into the equation, the increase of pro-environmental attitudes will then induce anti-economic development attitudes. Therefore this research hypothesizes that the increase in environmental knowledge affects attitudes toward economic development in negative ways.

H2 (a): EE negatively influences individuals' attitudes towards economic development

On the other hand, *ESD* demonstrates a way to utilize natural resources in a sustainable manner and to protect natural habitats (McKeown & Hopkins, 2003), while at the same time encourages economic and social developments. For example, knowledge of agricultural technologies, endangered vegetation, and ecotourism are introduced to counterbalance the current condition of degradation and to reach a decent living standard (Salas, 2001). The concept of eco-development is widely quoted by WCED to advocate "a responsible and sustainable use of environmental resources" (WCED, '987, p.43). *ESD* also enhances one's knowledge and skills in critical thinking (Hwang et al., 2000), as an individual learns to make changes to

resource management for long-term environmental and economic benefits.

Take ecotourism as an example, it is another widely accepted proxy of a successful sustainable development initiative (Tisdell & Wilson, 2005). Successful cases of integrating education for tourists and for local residents can benefit the economy by providing more local employment opportunities. And newly developed technologies can be applied to combat a number of environmental ills such as pollution. Additionally, government tax revenue from these associated activities can be wisely allocated to develop, for example, local infrastructure, sewage systems, and animal protection programs. These mechanisms will generate a win-win situation by ensuring concrete benefits to the local community in addition to the environment, and hence, a practical demonstrator of the extensive economic and social prospects of sustainability development (Coria & Calfucura, 2012; Wunder, 2000). Therefore when ecotourism is incorporated into the *ESD* program in this research, a positive change of attitude towards economic development is expected.

H2 (b): ESD positively influences individuals' attitudes towards economic development.

The Combining Effect - the contention gap

Hypothesis 3 examines the contention gap instigated by the education approaches due to the fact that contention between environmental conservation and economic development is a fundamental challenge to rural development in most developing countries (Du Cros et al., 2005). Studying the contention between

conservation and development is of utmost importance because it affects attitudes (Reading & Kellert, 1993; Torkar et al., 2010), and that the impact of conflicts is the key to determining one's choice between conservation and development.

To begin with, we have to re-emphasize that the foundation of this research is built on treating *EE* and *ESD* as two distinct education approaches. As *EE* covers the scientific aspects of environmental knowledge to educate the recipients how the environment has been damaged by human footprint, among other topics (Monroe, 2012). It is considered a straightforward education approach that provides a one-sided message. On the other hand, the literature of *ESD* indicates that the program content must include economic, social, and environmental factors with examples to illustrate the know-how for sustainability development as a package (Monroe, 2012). *ESD* provides a comprehensive solution-based education approach. As such, *ESD's* focus shifts from the environment to "humans" by providing hope that progress in technology will bring about necessary solutions to minimize human impact on the environment, and that there is a synergy between technology advancement and conservation (Sarabhai, 2011; Shohel & Howes, 2011).

The greater the understanding is of conservation instigated by environmental education, the stronger pro-environmental attitude results (McKenzie et al., 2004), but at the same time, economic developments that improve rural living conditions are imperative. Based on Hypotheses 1a and 2a, *EE* intervention alters the contention gap between attitudes towards environmental conservation and attitudes towards economic development.

Taking this research context as example, it is hypothesized that an individual, after attending *EE* lessons, will have a positive change of attitude towards environmental conservation under H1(a). At the same time, such an individual, under H2(a), is expected to be affected by guilty feelings from the harmful human impact on the pandas' habitat, hence he / she is hypothesized to generate a negative attitude towards development.

The contention gap hypothesized in H3(a) is a measurement of the difference in an individual's attitude towards conservation and development between pre- and post- education intervention. In view that the change of attitude towards conservation and development are expected to move in opposite directions, the contention gap is likely to widen after the education intervention.

H3 (a): EE increases the differences between individuals' attitude towards environmental conservation and individuals' attitude towards economic development.

However, the function of *ESD* is to provide the knowledge and analytical skills to realize sustainability in order to balance the consumption of natural resources. If students treat technology as a reliable source that may bring forth solutions for environmental problems, they will be more likely to engage in initiatives to synergize development and conservation. With the students' change in attitude and belief towards a win-win outcome for both environmental conservation and economic development, as illustrated in Based on H1(b) and H2(b), I have hypothesized that the contention between environmental conservation and

economic development will lessen after *ESD* intervention is applied.

H3 (b): ESD decreases the differences between individuals' attitudes towards environmental conservation and individuals' attitudes towards economic development.

METHODS

To conduct this research, *EE* and *ESD* are incorporated into a charity's education program in China. China is selected as the research context as the impressive average GDP growth of eight percent in the past thirty years has widened the wealth gap (Chinese Economy, 2010), and has caused mass exploitation of natural resources. Coupled with its status as having the largest population in the world with a huge demand for natural resources, the government has to secure the country's long-term economic development ([Park & Yang, 2012](#)). Another issue that hampers the efficient progress of China's sustainability development is that the government has tightened its funding and governing policies on environmental NGOs (Ho, 2001). Incidents, such as the Red Cross Society's financial scandal have given rise to public distrust of NGO's; money donated to the charities were mismanaged, including being transferred for personal use. This has resulted in an unprecedented crisis in the industry (China Daily). The accountability crisis in China mirrors the situation for international NGOs, which are now questioned by official authorities in various countries in reference to their contributions and "real intentions" in local communities. The worthy cause of

environmental conservation is further tainted by some NGOs' self-interest, collusive practices, political hypocrisy, and manipulation. As such, fund-raising through corporate social responsibility (CSR) initiatives of large corporations has become difficult (Spires, 2011), and the NGOs' diminished support for partnership continues to hinder the implementation of sustainability policies in China (Zhan & Tang, 2011). Another factor is that the Chinese society is still influenced by Confucius values (Wong, 1998) that people value social harmony and respect the viewpoints of authorities. However, with the Communist regime since 1949, some of these traditions have faded, and that has made China a unique research context distinctive from other research streams. Using Chinese society as a research context may help implement effective sustainability policies on the ground that balance population growth with demands for natural resources. This will also help to raise Chinese people's environmental awareness, which is key to maintaining order and stability in developing countries like China.

In order to facilitate this research, we have worked a reputable NGO in Hong Kong as our partner to implement this project. This research project took place in Foping village, Shannxi, China, which borders the Foping Nature Reserve. Foping village was officially established in 1978 and is located in the Qinling Mountains. The area spans both subtropical and temperate zones, covering 35,000 hectares of various types of landscape. The villages are comprised of mainly middle- to lower-class agrarian families. The neighboring Foping Nature Reserve is home to the wild giant panda and many animals under First-Class State Protection, like the golden monkey, takin, golden pheasant, and giant salamander. However, due to climate

change and human interference such as grazing, agricultural expansion, and deforestation, many resident species from the forest including the giant panda are endangered. We have chosen this study site for its rural location, unique biodiversity, and low living standards typical of Chinese villages (Caro, 1999).

Ten undergraduate students from the education department from a University in Hong Kong were selected to form the teacher group in this research. They were assigned to design and conduct both *EE* and *ESD* programs at each school to ensure the consistency of the education message and a total of eighteen workshops were provided to 747 students between ages six to twenty during a four-day visit. Local students were randomly assigned to attend the workshops based on the similarities in their age and their year grade. Each session lasted for about one-and-a-half hours with drama, lecture, songs, and interactive games especially designed for the local Chinese students.

As suggested by Torkar et al. (2010), knowledge through education towards a particular animal species can reinforce emotional concerns for such a species, the basic elements covered in the two educational interventions are geared towards panda conservation because Foping is located right next to the area with the world's greatest population of the species in the wild, and which has become the most vivid example of site-specific approach (Saterson et al., 2004). The students are able to establish a strong emotional attachment with the animal, and that in turn was aimed at raising their interests in the program according to Caccioppo's likelihood model.

This program is tailor-made for the local Chinese students, based on the

format of educational intervention literature (Contento et al., 2002; Cox et al., 1998; Cromley & Azevedo, 2007; McKenzie et al., 2004), and examples from the outcome of prior environmental learning research (Bailey and Watson, 1998). Literature from McKeown and Hopkins (2007) is drawn to develop the program content of both *EE* and *ESD*. The *EE* program contains three key features: panda habitat (ecologic), Shaanxi's environmental conditions (geographic), and the methods of protecting the habitat (conservation). *ESD*, on the other hand, includes the contents from *EE* with an additional two elements: the economic and social aspects based on the definition in McKeown & Hopkins (2003 & 2007). For easy understanding, the program is then combined with the ecotourism paradigm as a demonstrator of sustainable income source, able to generate positive socio-economic changes to a society (Wunder, 2000).

Jiuzhagou was selected as a successful example of ecotourism business in the country because it is one of the most popular UNESCO cultural and heritage sites in China. Jiuzhagou's win-win outcome which aligned with Ballantyne, & Packer's (2005) proposition is achieved through the collaboration of businesses and individuals, with a mission that encouraged a better conservation initiative to benefit not only the community but the ecosystem as a whole. From an economic perspective, the establishment attracts investments from the hotel and entertainment industries, which increase local job opportunities yet also raise the cost of living. As a balancing act, the government controls the number of investments in the reserve area as well as allocates financial support for conservation initiatives. The disadvantages of increased traffic accidents and crime

rate are managed by an expanded police force to complement the social benefits of an improved airport and road infrastructure. The other aspect is the conservational impacts - the side effects of tourism, such as pollution from traffic and water contamination are mitigated by the introduction of eco-friendly vehicles and an efficient sewage system. Congruent with the sustainability concept, Jiuzhagou successfully achieves social and economic sustainability (Pizam, 1978; Belisle & Hoy, 1980; Liu & Var, 1986; Milman & Pizam, 1988; Perdue, Long, & Allen, 1987; Lankford & Howard, 1994; Haralambopoulos & Pizam, 1996).

The students in this experiment learn through lectures, drama, games, songs, and reflection etc. (Chan, Chien, & Tso, 2009). Simple application-based (Shayo & Olfman, 2000) exercises are also introduced, such as encouraging students to borrow conservation related reading material from the library and communications with OPCFHK and other environmental NGOs. Students were revisited with focus group discussion three months after the education programs to find supplementary information to support the quantitative analysis in this study.

Survey was utilized in this research with the constructs adapted from previous research in the field. Questionnaire translation and the back-translation between English and Chinese were carried out independently by two certified professional translators (Brislin et al. 1973). Considering the participants' young age, the answer options followed a 5-point scale with anchors of +1 (least in favor of) and +5 (most in favor of) for simplicity. The construct attitude is adapted from Hinds and Sparks (2008), and three questions are asked about the attitudinal aspect.

The attitude towards environmental conservation change; namely, in the way people felt about the Giant Panda conservation are listed in Table 2

Table 2 Survey questions

"For me engaging in Panda protection is....."	Bad (1) – good (5) Not useful (1) – useful (5) Unpleasant (1) – pleasant (5)
"For me engaging in generating income is"	Bad (1) – good (5) Not useful (1) – useful (5) Unpleasant (1) – pleasant (5)

The research was conducted in 3 phases. In the planning phase (November 2011 to March 2012) - teachers group were formed to design the two education interventions based on prior literatures, survey questions were adapted and modified based on previous research. During the Experimental phase (April, 2012) questionnaires were distributed to all the students one week before the workshop. Thirty to fifty students were then randomly assigned to attend either the *EE* workshop or the *ESD* workshop, based on the similarity in their demographic distribution. After the intervention, another survey was answered immediately and the students' changes of attitude are inputted for quantitative analysis. In the post-event visit (July, 2012), a total of 18 participants, who had either attended the *EE* or the *ESD* sessions, were selected randomly to form focus group discussion. A third party was invited to join the meetings to form a triangulated focus group discussion. The dialogue was recorded, transcribed into Chinese, and translated into English for qualitative analysis.

RESULTS

The analysis comes in three stages. To begin with, items in the questionnaire are studied and answered by the pilot group. Internal consistency and reliability of the questionnaires on attitudes towards environmental conservation and on attitudes towards economic development are validated by SPSS version 21 (SPSS, 2012).

In the second stage, surveys collected are then paired up according to the names of the participants. To analyze the attitudinal changes, the scores from the three questions on attitude towards conservation and another three on attitude towards development are averaged out respectively. Cronbach's alpha are obtained to evaluate the internal consistency and reliability of the questionnaire (Cronbach, 1951), followed by the factor analysis, and discriminant analysis to evaluate measurement property of the data set. The average score from attitudes towards environmental conservation and that from attitudes towards economic development are compared and analyze by the paired sample t-test with the SPSS version 21 (SPSS, 2012).

Table 4 Demographic information

Description	Quantity
Total population in Foping (year 2004)	30,000
Total number of students in Foping (year 2004)	3,000
Number of schools visited	6
Number of <i>EE</i> workshops conducted	9
Number of <i>ESD</i> workshops conducted	9
Total attendees at the two workshops	903

Survey obtained with matching data between pre- and post treatment from both the <i>EE</i> and <i>ESD</i> workshops	747
Valid surveys from the <i>EE</i> workshops for data analysis	394
Valid surveys from the <i>ESD</i> workshops for data analysis	353

Reliability Test

The validity of the instrument scales is calculated by the reliability test by using SPSS to measure the Cronbach's alpha coefficients. Table 4 displays the mean, standard deviation, and Cronbach's alpha on the pretest, and posttest samples.

Table 4 Mean, Standard Deviation, and Reliability test on the constructs towards conservation before and after treatment

	<i>EE (N=37)</i>		<i>ESD (N=38)</i>	
Pilot test				
Pretest	Mean	SD	Mean	SD
Attitude towards Conservation	4.5676	0.680	4.500	0.605
	Cronbach's alpha =0.851		Cronbach's alpha =0.873	
Attitude towards Development	4.1171	1.169	4.7895	1.073
Posttest	Cronbach's alpha =0.861		Cronbach's alpha =0.797	
Attitude towards Conservation	4.8919	0.284	3.8772	0.165
	Cronbach's alpha =0.853		Cronbach's alpha = 0.770	
Attitude towards Development	3.5766	0.831	4.0614	1.122
	Cronbach's alpha =0.741		Cronbach's alpha =0.727	
Experimental study				
Pretest	<i>EE (N=394)</i>		<i>ESD (N=353)</i>	
Attitude towards Conservation	4.85	0.347	4.77	0.522
	Cronbach's alpha =0.712		Cronbach's alpha =0.867	
Attitude towards Conservation	4.12	0.913	4.07	1.099
Posttest	Cronbach's alpha =0.850		Cronbach's alpha =0.888	
Attitude towards Conservation	4.91	0.326	4.96	0.165
	Cronbach's alpha =0.736		Cronbach's alpha = 0.733	
Attitude towards Development	3.98	0.998	4.03	1.122
	Cronbach's alpha =0.910		Cronbach's alpha =0.943	

For internal consistency, the value of Cronbach's alpha of the constructs for both the *EE* and the *ESD* programs in both the pre- and post-test results are high in general and are greater than the recommended value ($\alpha > 0.70$), therefore the data

set is considered to be acceptable in this research (Larson, Green, & Castleberry, 2009).

The measurement model is then examined by factor analysis to statistically differentiate the four key constructs: attitude towards conservation before education, attitude towards conservation after education; attitude towards development before education; and attitude towards development after education. The statistical classification shown in Table 5 based on factor loading and cross loading identify that the same grouping of the key construct is aligned with the questionnaire designed for this research.

Table 5 Loading of the constructs

	Factor 1	Factor 2	Factor 3	Factor 4
Economic development after education (item 2 - for me engaging in generating income is not useful / useful)	0.934	0.131	0.327	0.029
Economic development after education (item 3 - for me engaging in generating income is unpleasant / pleasant)	0.918	0.097	0.324	0.058
Economic development after education (item 1 -for me, engaging in generating income is bad / good)	0.909	0.092	0.370	0.066
Panda conservation after education (item 2 - for me, engaging in panda protection is not useful / useful)	0.131	0.898	0.049	0.300
Panda conservation after education (item 1 - for me, engaging in panda protection is bad / good)	0.094	0.869	0.054	0.383
Panda conservation after education (item 3 - for me, engaging in panda protection is unpleasant / pleasant)	0.074	0.784	0.075	0.404
Economic development before education (item 2 - for me, engaging in generating income is not useful / useful)	0.345	0.013	0.893	0.109
Economic development before education (item 3 - for me, engaging in generating income is unpleasant / pleasant)	0.345	0.000	0.870	0.060
Economic development before education (item 1 -for me, engaging in generating income is bad / good)	0.295	0.034	0.868	0.126
Panda conservation before education (item 3 - for me, engaging in panda protection is unpleasant / pleasant)	0.055	0.317	0.119	0.850
Panda conservation before education (item 2 - for me, engaging in panda protection is not useful / useful)	0.075	0.363	0.158	0.8497
Panda conservation before education (item 1 - for me, engaging in panda protection is bad / good)	0.020	0.366	0.005	0.7943

The measurement model is then validated in terms of composite reliability and average variance extracted in Table 6.

Table 6 Cronbach's Alpha, Composite Reliability, Average Variance Extracted

Constructs	Cronbach's Alpha		Composite Reliability	Average Variance Extracted
	EE	ESD	EE & ESD	EE & ESD
Per-treatment attitude towards conservation	0.712	0.867	0.87	0.69
Post-treatment attitude towards conservation	0.850	0.888	0.89	0.73
Per-treatment attitude towards development	0.736	0.733	0.91	0.77
Post-treatment attitude towards development	0.910	0.943	0.94	0.85

Finally the Pearson correlation matrix of the constructs are calculated and presented in Table 7 and it is affirmed that the constructs of attitude towards conservation before and after the education, and constructs of attitude towards development before and after the education are correlated with each other. It is also observed that the square root of the average variance extracted is higher than its correlations with all other constructs in this study in Table 7.

Table 7 Correlations Matrix

	Pre-treatment Attitude towards conservation	Pre-treatment Attitude towards conservation	Post-treatment Attitude towards development	Post-treatment Attitude towards development
Pre-treatment Attitude towards conservation	1 (0.83)			
Post-treatment Attitude towards conservation	0.239**	1 (0.85)		
Pre-treatment Attitude towards development	0.102	-0.20	1 (0.88)	
Post-treatment Attitude towards development	0.065	0.130**	0.375**	1 (0.92)

Correlation is significant at (one-tailed) * 0.05 level ** 0.01 level

Note: Square root of the average variance extracted is shown on the diagonal. Off diagonal elements are the construct s' correlation For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Confirmatory factor analysis is then conducted to confirm the desired level of the factors regarding the inter-correlations among all the factors. Table 8 indicates that the overview of fit indices for different factors within the confirmatory factor is at an acceptable level.

Table 8 Confirmatory Factor Analysis

Goodness of Fit Indices	EE	ESD	Desired level
X ² / DF	2.203	1.389	< 5
TLI	0.965	0.990	> 0.9
DFI	0.974	0.992	> 0.9
SRMR	0.0362	0.0289	< 0.08
RMSEA	0.055	0.033	< 0.08

The Bright side effect of environmental education

In this study, attitude towards conservation and development refer to the individuals' positive or negative valuation towards panda protection and local economic development respectively (Ajzen, 1992). Paired t-test is conducted to examine the differences in attitude towards conservation between the pretest and posttest surveys.

The results in Table 9 demonstrate a significant increase ($p=0.0015$) in the overall conservation attitudes from the pretest ($M=4.85, SD=0.347$) to the posttest ($M=4.91, SD=0.326$) of the *EE* program. There is also a significant increase ($p=0.00$)

in conservation attitudes from the pretest ($M=4.77$, $SD=0.522$) to the posttest ($M=4.96$, $SD=0.165$) of the *ESD* program.

Table 9 Paired t-test results for attitude towards conservation

	<i>EE</i>	<i>ESD</i>
	Mean Difference Post-attitude minus Pre-attitude (<i>p</i> -value, one tailed)	Mean Difference Post-attitude minus Pre-attitude (<i>p</i> -value, one tailed)
Attitudes towards conservation	0.0635** (<i>p</i> =0.0015)	0.1889** (<i>p</i> =0.00)
Independent t-test result to compare attitude change between <i>EE</i> and <i>ESD</i>	(p =0.00)**	

Significant at (one tailed) *0.05 level ** at 0.01 level

To conclude the hypotheses, findings in this section confirm that both *EE* and *ESD* have significantly increased participants' attitude towards conservation. Therefore, both hypotheses H1(a) and H1(b) are supported.

The Flip-side effect of Environmental Education

Another objective of this study is to explore the flip-side effect of the *EE* and the *ESD* programs in terms of changing the participants' attitude towards development. To this end, we compute the differences in attitude towards development between the pretest and posttest data by a paired t-test analysis.

Table 10 shows a significant decrease ($p= 0.004$) in attitude towards development among the attendees between pretest ($M=4.12$, $SD=0.913$) and posttest ($M=3.98$, $SD=0.998$) due to their participation at the *EE* workshops. However, looking at the attitudinal changes towards economic development as a result of participation at the *ESD* workshops, the pair t-test results certify that the

pretest ($M=4.96, SD=0.165$) to the posttest ($M=4.03, SD=1.122$) change of ($p=0.266$) is not significant. This result acknowledges that only *EE* casts the flip-side effect from the double-edged sword that instigates anti-development attitudes.

Table 10 Paired t-test result for attitude towards development

	<i>EE</i>	<i>ESD</i>
	Mean Difference <i>Post-attitude minus Pre-attitude</i> (<i>p</i> -value, one tailed)	Mean Difference <i>Post-attitude minus Pre-attitude</i> (<i>p</i> -value, one tailed)
Attitudes towards development	-0.14467** (<i>p</i> =0.004)	-0.03588 (<i>p</i> =0.266)
Independent t-test to compare attitude change between <i>EE</i> and <i>ESD</i>	(<i>p</i> =0.0835)	

Significant at (one tailed) *0.05 level ** at 0.01 level

In summary, the findings illustrate that male participants in the *EE* group develop anti-development attitudes and support hypothesis H2(a), whereas the hypothesis that *ESD* can trigger pro-development on the students in H2(b) is not supported.

Contention gap between environmental conservation and economic development

The contention gap is computed by the difference between attitude toward conservation and attitude towards development. Table 11 demonstrates the paired-t test results for the change in contention gap. The change for *EE* is significantly increased ($p=0.00$) from pretest ($M=0.7271, SD=0.94285$) to posttest ($M=0.9298, SD=1.00852$). For *ESD*, as shown in Table 11, there is also a significant change ($p=0.00$) in the contention gap from before ($M=0.6988, SD=1.05868$) to after the treatment ($M=0.9235, SD=1.11781$). In contrast to the hypothesis that *ESD* can

mitigate the contention gap, the results show that the contention gap is not converged but is in fact diverged.

Table 11 Paired t-test result for the change in contention gap

	<i>EE</i>	<i>ESD</i>
	Mean Difference <i>Post-gap minus Pre-gap</i> (<i>p</i> -value, one tailed)	Mean Difference <i>Post-gap minus Pre-gap</i> (<i>p</i> -value, one tailed)
Contention gap change	0.20812** (<i>p</i> =0.00)	0.22474** (<i>p</i> =0.00)
Independent t-test to compare contention gap change between <i>EE</i> and <i>ESD</i>	(p =0.419)	

Significant at (one tailed) *0.05 level ** at 0.01 level

In summary, *EE* produces a significant increase in the contention gap and therefore H3(a) is supported. Yet, what hypothesis H3(b) indicates, that *ESD* can produce among the students a pro-development attitude so that the contention between conservation and development can be mitigated, is not supported.

Socio-demographic characteristics

According to certain prior research, gender (Torkar, Mohar, Gregorc, Nekrep, & Adamič, 2010), place of attachment (Rollero & De Piccoli, 2010), and economic pressure (Elder, Conger, M., & Ardel, 2003) are some of the major factors associated with pro-environmental behavior (Cloquell-Ballester, Monterde-Diaz, Cloquell-Ballester, & Torres-Sibille Adel, 2008; Grodzińska-Jurczak, Stepska, Nieszporek, & Bryda, 2006; Hernández, Carmen Hidalgo, Salazar-Laplace, & Hess,

2007; Jackson, 1993). However, these factors' association with pro-development behavior on Chinese students, if any, is unknown, and further investigated based these three different factors independently and collectively for an in-depth understanding of their impacts.

To categorize place attachment, the first question included in the survey is modified from "place of origin" (Rollero & De Piccoli, 2010) as "Is this your place of origin?" (yes / no). Another question is adapted from Raymond et al (2010) regarding of family bonding that induces place attachment (Kyle & Chick, 2007) as "Do your parents live here? (both do / only one does / neither does). An individual's answers to these two questions are added together, and the total score is then used to catalog the attendee into either the "high place attachment" group – score ranging from 2-3 or "low place attachment" group – score ranging from 4-5.

On the other hand, as the subjects in this research are school children and they might not be able to provide accurate data about their socio-economic status (Morgan-Brown, Jacobson, Wald, & Child, 2010). Questions postulated by (Shi, Lien, Kumar, Dalen, & Holmboe-Ottesen, 2005) to determine wealth status are adopted and converted to (1) "Does your family own a house?" (yes or no), adopted from (Bollen, Glanville, & Stecklov, 2001; Karim, 1990) "amount of land owned"; (2) "Does your family own a car?" (yes or no), adopted from (Levine et al., 1991) "household appliances owned". A participant's answers for the above two questions are first added together, and the total score is then used to catalog the participants into three categories: Low economic pressure group (total score of 2), median

economic pressure group (score of 3), and high economic pressure group (total score of 4).

The results indicate that the subgroups: the male participants, the "Non-native", and the "Poor", show a similar movement trend as *EE*; a significant decrease in attitude towards development after the *EE* workshops. On the other hand, the same socio-demographic groups who attended the *ESD* workshops show insignificant changes in their attitude towards development. The results not only identify the differences between *EE* and *ESD* groups but also indicate that these subgroups (the "Non-native", the "Poor", and the male participants) are development-sensitive and are more likely to be influenced by the one-sided, persuasive message of the *EE* workshops.

To further investigate the crossing effect of these factors, it is interesting to notify that *EE* makes a significant impact on the "Poor-Non-native" ($M=-0.8889$, $SD=1.15331$, $p=0.0005$) by decreasing their developmental attitudes on the assumption that the "Non-native" are prone to set limited development for environmental protection purposes. On the other hand, the "Poor-Non-native" in *ESD* experiences a significant increase ($p=0.006$) in attitude towards development. The differences between *EE* and *ESD* upon the "Non-native" distinguish the impact from these two different education approaches and suggest that this sub-group is susceptible to the persuasion messages from both the *EE* and the *ESD* programs.

DISCUSSION

The findings of this research indicate that the two environmental education approaches, *EE* and *ESD*, are able to encourage an increase in attitude towards conservation. It is also observed that *EE* generates anti-development attitudes and that the overall effects of *EE* are in line with the hypothesis that it diverges individuals' contention gaps by boosting both their pro-environmental and anti-developmental attitudes.

The reason that *EE* is a radical education approach can be traced to the program structure's focus on environmental conservation, which boosts students' attitudes towards conservation. This one-sided message has also stimulated students' feelings of guilt (Halpenny, 2010) for the damages that human activities have done on panda habitats resulting in turn in attitudinal changes towards anti-development.

Although *ESD* is not aligned with the hypothesis to generate pro-development attitude with the purpose of reducing the contention gap between conservation and development, *ESD* has significantly increased attitude towards conservation. In general, the increase of contention gap in *ESD* is mainly due to the concept of sustainability development has stimulated a powerful increase in conservation attitudes. The reason for having such a strong influence may be that when the *ESD* program was designed for this research, a vivid example was included in the lecture (a successful ecotourism development example in Jiuzhaijou) to enhance the students' learning outcome (Ramsden, 1991). Taking further support

from the focus group discussion, students in the *ESD* group in general show more enthusiasm in discussing their feelings about the program content than the *EE* group. In addition, more than 40% of those students requested an elaboration on the *ESD* program “...*We would like to understand how ecotourism can bring forth a co-existence of conservation and development in Foping. What exactly is ecotourism? How can it ensure a balance between conservation and development?*”. Therefore, *ESD* is observed to create a stronger impact than *EE* in terms of boosting pro-environmental attitudes.

According to prior literature, children are more emotionally attached to the place where they grow up, and their ties with their land stimulate their pro-environmental behavior (Halpenny, 2010). Results indicate that the “Native” are motivated by the education programs of both *EE* and *ESD* and show an increase in pro-environmental attitude change, thus those with higher place attachment are more emotionally attached to their surroundings as suggested by Cloquell-Ballester et al. (2008). On the other hand, earlier discussion confirms that *EE* has a double-edged effect of developing an anti-development attitude, and this observation only exhibits among the “Non-native” group. Placing this anti-development attitude side by side with the observation that the “Non-native” lack a pro-environmental attitude change leads me to suspect that they are development-sensitive. Those with less place attachment to Foping may develop anti-development strategies to deal with environmental protection campaigns if they are motivated by a strong conservation message as a result of their education. The rationale to the research finding may be that the “Non-native” value the physical fabric of their neighborhood more than the

potential benefits from economic development because they may not be entitled to share such benefits (Manzo & Perkins, 2006).

In this research, after the students participated in the education treatments, the "Rich" group experiences, in general, an increase in conservation attitude change without significant anti-development attitude formation. The findings indicate that the "Rich" is not easily manipulated even when they are treated with an extreme and one-sided *EE* education message. Contrastingly, families with higher economic pressure may have contributed to their children's lower self-esteem and poorer intelligence level (Rhodes and Wood, 1992). This may have negatively affected their children's critical thinking skills in learning, and the latter may be easily manipulated by the education message. The findings that the "Poor" are having a negative change of attitude towards development facilitated by the *EE* program, which leads to a widening of their internal contention, and that a pro-development attitude appear in the "Poor-Non-native" group further suggest that they are development-sensitive and are easily influenced by the persuasive power of the education treatments (Yoo et al, 2013).

With regards to the impacts of *EE* and *ESD* on the female participants versus the male participants, the consolidated findings of this research suggest that the male participants' gender status is the main reason for their anti-development attitude formation in the *EE* program. On the other hand, the female participants from the *ESD* group as a gender group is the main reason for the increase in their conservational attitudes that leads to the increase in their contention gap after the

completion of the *ESD* program. Therefore, the findings postulate that female participants are more conservation-conscious, whilst male participants are more development-sensitive and are willing to sacrifice economic developments for conservation initiatives. The findings confirm the literature of Tikka, Kuitunen, and Tynys (2000) that males are more prone to master nature and to derive benefits from natural resources (Sahin et al., 2012). For the male participants, the concept of conservation learnt from *EE* is tightly related to how human developments have been harmful to nature. Therefore, they demonstrate their conservation intentions by advocating limited economic developments. Also in line with the literature on gender and environmental science is that females are more environmental-sensitive (Van Liere & Dunlap, 1980), and that due to their physiological nature, they tend to appreciate prosperity for its long term effects (Wilson, Daly, & Gordon, 1998). Although Jackson (1993) posits that women's specific agency relationship with the community, such as their socio-economic status, affects their relationship with their environment, its impact does not apply to this research's participants as they are students and do not play a part in any agency effects. Other research support that women are more conservation-sensitive (Arjunan et al., 2006) and that they show a greater interest in environmental problems (Cloquell-Ballester et al., 2008). This assertion is well acknowledged, and that explains why in this research, female participants exhibit pro-environmental attitudes after the education interventions.

Few findings call for further elaboration: First, the "Poor-Non-native" participants in the *ESD* group experience an increase in attitudinal change towards development and the contradictory result from the *EE* indicates that the same group

of participants experience an entirely opposite impact yielding the most undesirable result among all subgroups - a decrease in attitudes towards development that induces a widening in their contention gap. This finding can be logically derived from the consolidated effects of the double-factors: "Poor" - easily influenced by the radical education approach, and "Non-native" - development-sensitive. In the *ESD* case, they may take preference with the content of *ESD* that enables them to understand the concept of ecotourism as a proxy in this research, thus encouraging an increase in pro-development attitudes. However, without vivid examples to simulate participants' acceptance of the co-existence of conservation and development from the *EE* intervention, they are then deeply enhanced by the double-edged effect of *EE*.

Second, the double-edged effect inducing an attitude towards conservation increase, along with a decrease in attitude towards development, as well as a diverged contention gap, have appeared among the "Native" female participants from the *ESD* program. This surprising effect may, particularly among the "Native" female participants, be attributed to the fact that females are very environmental-sensitive (Van Liere & Dunlap, 1980; Wilson, Daly, & Gordon, 1998) and supportive of conservation (Arjunan et al., 2006), and therefore such a great interest in environmental problems may be intensified. Based on the transcribed response from the focus group discussion: when female participants in the *ESD* group were asked to choose between conservation and development, all of them reported their preferences for conservation. When they were asked to comment on the co-existence of conservation and development, they responded that they did not

understand how ecotourism could bring forth a balance between conservation and development, and none of them declared that they believed in such a co-existence. As such, to introduce economic elements to female participants deeply concerned about environmental issues, one should not establish the logic for a sustainable future, especially if the concept is not thoroughly delivered.

These findings with regards to the strengths and weaknesses of *EE* and *ESD* among particular socio-demographic groups call for future research to justify the analyses drawn from this research. It also alerts the government, the schools, and the NGOs to pay extra attention to monitoring the impacts on these groups of recipients when environmental education is delivered to them in the future.

Theoretical Implications

This research takes a novel approach in the field of environmental education. It incorporates *EE* and *ESD* in an experimental setting that compares the effectiveness of the two education programs with a large sample size in China and be able to distinguish the different impacts of *EE* and *ESD*. By including a flip-side effect of environmental education which prior research have neglected so far, it is able to empirically confirm anti-developmental attitudes as the manifestation of the double-edged effect of environmental education. Experimental evidences suggest that attitudes towards development should also be addressed in future environmental education research. The investigation that addresses the conflicts within sustainability development among Chinese students has not been properly addressed in prior research, may therefore shed light on a potential new research

focus and enrich literature on sustainability development by providing quantitative findings in sustainability development for future conceptualization.

The findings in this research indicate that *EE* is a one-sided, persuasive educational approach and *ESD* is a more balanced approach responds to the long held debate about *EE* and *ESD* and suggests that neither of the educational approaches should be categorized under the other. Indicated in prior research is that people try to use different excuses to avoid changing their lifestyles to cope with conservation initiatives (Sarabhai, 2011). Therefore an increase in attitude towards conservation may not be enough to sustain the conservation drive in particular groups of people. That being the case, anti-development attitudes may be utilized to extend the mileage of conservation initiatives and to slow down economic development, allowing natural resources to replenish before they are depleted.

Using China as a research context also enriches existing literature and case study research in environmental education with a quantitative analysis. As *ESD*'s current implementation in China focuses on urban schools, this research may provide empirical evidences for future comparisons of attitudinal changes between urban and sub-urban students.

Furthermore, this research enriches academics' understanding of the socio-demographic characteristics of Chinese students, paving the way to future investigations into the environmental behavior of the younger Chinese generations. The fact that *EE* and *ESD* cast a completely reversed impact on the "Poor-Non-native" participants, illustrates their susceptibility to the influences of different

educational approaches. Focusing on the impact of education on this particular group including the adults, or extending the research to city students, may provide a more in-depth understanding of the main driving factor -- be it an identity issue or something related to the perceived benefit issue, or some other factors that induce such an impact on them. Once the main factor is identified, it can serve as a reference for future environmental education programs. Researchers in the environmental education stream may then tailor the program by first fixing these psychological hindrances to eliminate the possibility of a negative impact arising from the internal contention instigated from the educational approach.

Practical Implications

The unique experimental setting of this research constitutes a real life environmental charity project in China, which provides a successful case reference for the Chinese government to recognize the positive outcome of environmental charity campaigns (Bartholomew, Parcel, & Kok, 1998; Sousa et al., 2011) and may provide valuable experiences and insights for people who want to use similar programs to change people on the ground in China or in other developing countries.

As China has been implementing *ESD* in many major cities since 1978, this project provides a reference to further extend *ESD* into rural China. Apart from incorporating *ESD* into the formal curriculums, pedagogical developments of *ESD* can also be implemented as after school activities with parents' involvement to

strengthen its educational effects. The successful implementation of *EE* and *ESD* on the ground potentially addresses the Chinese government's call for future exploration of *ESD* in China (Yang et al., 2010; Zhang, 2010).

Organizations engage in corporate social responsibility (CSR) activities to meet the expectations of their stakeholders and of the public (Berger, Cunningham, & Drumweight, 2004; Wu, Auld, & Lloyd, 2008). However, most of their charity projects with a green initiative only highlight their positive effects and practical issues (Spires, 2011). Hence, those charity projects may only involve a form of cash donations, which merely provides a superficial measure while lacking a thorough assessment or quantitative measurement of their conservation success. The double-edged effects of *EE* and *ESD* examined in this research suggest that some projects may create anti-developmental attitudes and an increase of conflicts on the ground (Ko & Stewart, 2002), which may unintentionally create hostility to the company which sponsor these charity campaigns. The quantitative measurements of the effectiveness of conservation initiatives and the comprehensive findings may provide a systematized evaluation of *EE*'s and *ESD*'s impact with full cost-and-benefit references as future project guidelines (Saterson et al., 2004). Corporations engaged in CSR activities may identify a suitable NGO project that is aligned with their stakeholder's expectations, so that the finite CSR funding can be allocated optimally (Sachs, Maurer, Rühli, & Hoffmann, 2006). By understanding the dynamics of the education programs in this research, this project allows adaptive management to replicate its success in the future. Corporations will be able to tailor

their charity programs to benefit their target groups according to their corporate mission (Sachs et al., 2006).

The quantitative research sponsored by this environmental education program provides insight into the improvements for future charity campaigns. As funding is always a key challenge that affects environmental NGOs' non-profit campaigns (Haigh, 2006), learning from this project, NGOs can better establish an effective measurement that is aligned with their donors' objectives and that helps them solicit repeated funding more efficiently (Heimlich, 2010; Holden, Shiferaw, & Wik, 1998). In addition to funding, the reputation risks to NGOs may be reduced; reputation is very important to NGOs as they are in the front line to promote charity initiatives, and the way they present their messages has a great influence on the end-users (Ho, 2001; Tang & Zhan, 2008), especially those in developing countries where local environmental conservation projects are implemented (Collier and Dollar, 2001). Lately, there have been heated debates on whether NGOs create enemies due to their track records of instigating conflicts in the past few years. To ensure that the NGOs are on the right track, the measurement of the educational approach's effectiveness needs to shed light on the techniques of investigation of their impacts based on the framework of International Development.

Limitations and Future Research

Despite the theoretical implications and the managerial contributions discussed in the previous section, it is important to state that the research is subject to some type of limitations. First, all of the studied targets in this research are full

time students, and their attitudinal changes may be due to their being more receptive to the education content. With the engagement of different stakeholders including the government, NGOs, and the local residents in this study, future research may extend to investigate the impact of environmental education upon these adults, with reference to how agency relations may yield different results in the same research context (Jackson, 1993).

Secondly, this research only aims at collecting data in two experimental settings limited to a four-day visit. Further longitudinal studies may provide a more accurate finding regarding attitude changes of the individuals, while extending the process will likely produce more significant findings. Due to the fact that the dynamics of the environment and the people's insight into the project may change during the research period, only if we prolong the research would we be able to follow a more accurate measurement of their performances to ensure the objectives of the program are achieved. Longitudinal research can also strengthen the validity of the findings with follow up measures on the declining effects -- the declining effects imply that even if there is an increase in the contention gaps, the increase can be converged in the long run. In addition, the findings of a longitudinal research may offer the educator a viable reference point to monitor the impact of any side effects of environmental education programs on the ground, of which possibilities include producing environmental extremists – that would be in conflict with the original objectives of environmental education.

Third and finally, contrary to the hypothesis developed for *ESD* in this research, *ESD's* inability to facilitate an increase in attitudes towards both conservation and development, in other words, the co-existence of conservation and development in this research, is due to *ESD* being designed and delivered by amateurs, and that the concepts were not engaging enough to cast such an impact among the students. To strengthen *ESD's* implementation, further modification of the program with a local focus catered to the target audience is necessary (Jickling, 2010). In addition, to re-compare *EE* against an enhanced *ESD* may verify whether *ESD* is able to decrease or close the contention gaps. On a broader basis, monitoring changes in attitudes from the learner's perspectives may provide information for program development. Hence, the research may materialize a win-win education program that best fits Chinese students and eventually the environment and the ecosystem (Greene, 2010).

Conclusion

Broadly outlined in the previous conservation-oriented literature, conservation and development are in direct conflict with each other (Brown, 2002), and one of the solutions to overcome such a conflict is to educate the young generation about environmental conservation concepts (Maikhuri, 2001) and [?] to alter their attitudes towards sustainable environmental development (Hulme and Murphree, 1999). What is it that makes environmental education effective in terms of fostering students' belief in the co-existence of conservation and economic

development? The current study aims at investigating the two environmental education programs widely used internationally - *EE* and *ESD* - in an experimental setting to conduct a thorough comparison of their effects on the participants' changes in attitudes to understand how the two education approaches may be able to change individuals' internal contention between environmental conservation and economic development.

Our research does not take a position for or against any one of the two education programs. However, the evidences from this research indicates that the impact of the two approaches produce different results. The cross-examination of socio-demographic factors identifies the groups of students who should be studied thoroughly to ensure whether it is the program that is not suitable for them or that they might have some hidden issues leading to an extreme attitude change after the education program. In other words, the thesis demonstrates that when governments or NGOs use education in their campaign effort to secure social harmony, they should be extra cautious about involving specific socio-demographic groups.

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