Title: Making the case for environmental education in China

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Abstract

We examine the effects of schools and parents, the two of the most important sources of influence, on views of human-nature relationship of 6th grade primary school children in China. Adopting five items of the modified new ecological paradigm scale, we measured both child and his/her parent's views on human-nature-relationship (HNR). On average, children score higher on the HNR indicators than their parents but both are correlated. Attending a green school and parents' HNR scores are positively associated with children's HNR scores. Furthermore, obtaining higher education is associated with parents' HNR scores, which can be transmitted to children. Thus, the study makes a strong case for more equitable education, and environmental education in particular, that nurtures environmentally friendly worldviews among the future generations in China.

Highlights

- Children have more environmentally friendly worldviews than their parents
- Attending a green school was positively associated with children's environmental worldviews
- Intergenerational transmission of environmental worldviews existed
- Obtaining higher education was associated with parents' environmental worldviews

Key words: Environmental worldviews, environmental education, new environmental paradigm, equity, China

1. Introduction

Environmental education cultivates people's appreciation of nature, transmits knowledge about the environment, and nurtures environmentally friendly behaviors. At the core, environmental education is to help students develop a relationship with nature that is no longer strongly anthropocentric. The paradigm change has been considered indispensable for the pursuit of sustainable development by academics (Dunlap and Van Liere, 1978, , 1984). Similarly, international organizations such as the United Nations and policymakers have also considered environmental education a basis for the pursuit of sustainable development and have promoted it at international conferences and among national governments.

Recommendation 96 of the Stockholm Declaration (1972) called for the development of environmental education as one of the most critical elements of an all-out attack on the world's environmental crisis. Since then, the UNESCO and UNEP have advocated for schools and communities' incorporating teaching materials and various activities to raise students' environmental awareness, increase their knowledge about the environment, change their attitudes toward the environment, develop their skills in analyzing environmental problems, and facilitate their participating in environmental protection (UNESCO, 1997). Both developed and developing countries have planned and carried out various environmental educational programs and activities (Adara, 1996; Bekalo and Bangay, 2002; Blum, 2008; Gottlieb et al., 2012; Nomura, 2009; Tsai, 2012).

China has also endorsed internationally agreed principles and has been incorporating environmental education into the formal education system. The 1970s and 1980s observed the gradual development of environment related teaching materials. In 1992, the National Commission on Education explicitly required primary schools to include subjects such as geography and nature that would teach students about environmental knowledge and nature conservation (National Commission on Education, 1992). Furthermore, the then National Environmental Protection Administration, the National Commission on Education, and the Propaganda Department of the Chinese Communist Party jointly promulgated the National Guidelines for Environmental Communication and Education (1996-2010) in 1996. Besides instilling environmental education in the regular curriculum of all levels of education, the Guideline advocated for developing featured green schools starting in 2000 in China that incorporate environmental considerations in campus development, school management, teaching materials, extra-curricular activities, and community engagement. Local educational bureaus work together with environmental protection bureaus to evaluate self-nominated schools within their jurisdictions and offer the title of Green School to those qualified (National Environmental Protection Administration et al., 1996).

Presumably, green schools have a greener campus and offer better opportunities for their students to learn environmental knowledge and develop environmentally friendly worldviews and behaviors. Outside school, students also socialize with family members and friends, and society broadly defined, through social media such as watching television programs. For primary school children in China, parents normally regulate their activities by prescribing who they can play with and when, what TV programs to watch and when, and what books to

read. Thus, influence from parents on their children, especially of a young age cannot be overlooked. This paper aims to understand how primary school children in China perceive their relationship with nature and whether schools and parents have an impact on their perceptions.

The objective of the present paper is to use a tailor-made survey to investigate what explains human-nature perceptions among Chinese preadolescents when controlling for human-nature perceptions among their parents. Previous studies have treated children and adults as two separate populations and the influence of parents on their children's environmental worldviews has largely been overlooked. We adopted the five items on relationship between humans and nature in the modified New Environmental Paradigm (NEP) scale developed by Manoli, Johnson, and Dunlap (2007) for children and translated these into Chinese using simple language that is understandable for 10-12 year olds. We hope to investigate the impacts these two important sources of influence, school and parents, on perceptions of human-nature relationship of 6^{th} grade primary school children in China. The study will offer insights on factors that are significant in the socialization of primary school children and inform future practices of environmental education.

The rest of the paper is organized as follows: Section 2 reviews previous studies on measuring environmental worldviews and understanding its correlates, which helps set up a conceptual analytical framework and lays a foundation for empirical analysis. Section 3 restates the research questions and describes the methods. Section 4 presents the results and Section 5 concludes the paper.

2. Measuring environmental worldviews and understanding its impacting factors

2.1 Measuring people's environmental worldviews: new environmental paradigm

To understand people's "fundamental views about nature and humans' relationship to it," Riley E. Dunlap and Kent D. Van Liere developed a NEP scale in 1978 (Dunlap and Van Liere, 1978) and modified it later on (Dunlap, 2008). The NEP "focused on beliefs about humanity's ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity's right to rule over the rest of nature" (Dunlap et al., 2000), page 427). The NEP scale has been validated by scholars in multiple countries and gained worldwide significance (Hawcroft and Milfont, 2010). Although most of the studies have been targeting adult populations, in 2007, Constantinos C. Manoli, Bruce Johnson, and Riley E. Dunlap developed a modified NEP scale for children and validated it in the U.S. (Manoli et al., 2007). Based on an earlier version of their paper presented at the 2005 Annual Meeting of the American Educational Research Association, van Petegem and Blieck (2006) adopted their NEP scale and compared children aged 13-15 in Belgium and Zimbabwe (van Petegem and Blieck, 2006).

In China, the original 12-item NEP scale was first applied to adults aged 18-69 in 2003 by Dayong Hong. He confirmed the validity of the survey instrument in the Chinese context (Hong, 2005, , 2006). Later on, a few researchers in China studied the appreciation of nature by tourists and their environmental awareness measured by the NEP scale (Li, 2006, , 2009;

Luo et al., 2009). The most recent study examined the stakeholders' perceptions regarding conflicts on local communities' accessing protected areas protected area-community conflicts and whether environmental attitudes measured by the NEP scale had any effect (Liu et al., 2010). Of course, many more studies in China have used NEP scale or its revisions. But little knowledge has been accumulated in China on children's environmental worldviews and its impacting factors.

2.2 Impacting factors of environmental worldviews

Demographic features and individual beliefs

In terms of environmental worldviews, scholars found some demographic features such as gender (Taskin, 2009) and ethnicity (Johnson et al., 2004), and individual religious beliefs (Nooney et al., 2003; Peterson and Liu, 2008) to be correlates. But scholars have failed to find consistent results regarding the above factors on environmental attitudes and behaviors (Olli et al., 2001). At the same time, scholars also argued for forces both within families and in the broader socio-economic context in which a person or groups of people are socialized that affect NEP scores. For example, Taskin (2009) found Turkish senior high school students in public high schools, females, students with well-educated parents in white-collar professions, and students with liberal parents have more NEP or broader pro-environmental attitudes than others (Taskin, 2009). Children aged 13-15 in Belgium and Zimbabwe were found to perceive human-nature relationship differently, partially because of different ways of the production

and cultural representation of nature in the two different societies (van Petegem and Blieck, 2006).

Educational background

Education is another important socialization process in society, especially for younger generations. Studies of environmentalist attitudes, worldviews, and behavior, have inevitably included education as one of the predictors. Typically, additional years of education are associated with pro-environmental views and actions (Dietz et al., 1998). Higher education was found to be positively associated with environmental concern because highly educated people can acquire environmental information more easily and can think critically and form independent judgments (Olli et al., 2001). However, there are mixed results in these studies, especially in regard to post-secondary education. One study using the NEP scale found that "surprisingly, postsecondary education level was not related to higher NEP scores… [but] was a much stronger predictor of all four environmental behaviors" (Johnson et al., 2004) (page 180). The impact of education on environmentalist attitudes and behavior has also not been very well theorized or explained.

Intergenerational transmission

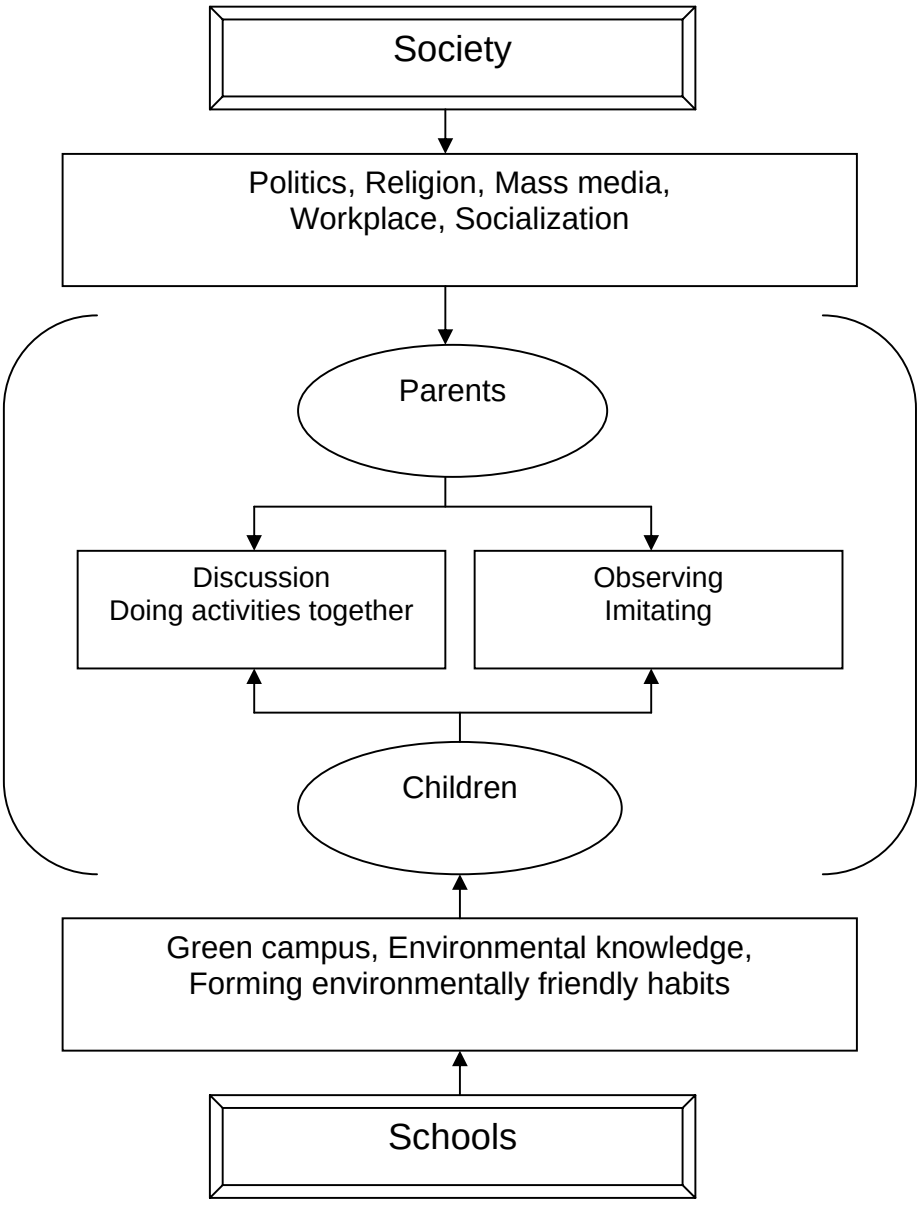
Society reproduces itself mainly through families. Parents influence their children both genetically and culturally. Scholars confirmed intergenerational transmission of IQ scores (Ramanathan et al., 2010), preferences (Dohmen et al., 2006), and income levels (Björklund

and Chadwick, 2003; Chadwick and Solon, 2002). Studies also found resources available to parents and their backgrounds impacted the educational attainment of their children (Conley, 2001; Ferguson, 2006; Steelman and Powell, 1989). The reproduction of economic inequality across generations has been well-researched, but intergenerational transmission of preferences has received less attention, partially because preferences are less observable and more difficult to measure. Even so, scholars have found evidence for intergenerational transmission of volunteering activities both in the U.S. (Mustillo et al., 2004) and the Netherlands (Bekker, 2007). Environmental worldviews can also be transmitted from parents to their children by parents' selecting leisure activities, extra-curriculum reading materials, and topics of family discussion.

Those results confirmed that there are multiple factors operating at different levels in the socialization processes impacting and shaping individual environmental worldview. Boeve-de Pauw et al. have rightly pointed out, "worldviews are not stable or innate characteristics within individuals, but can be influenced by interactions between the individual and its context" (Boeve-de Pauw et al., 2011) (page 109). Thus, we do not take children's perceptions of human-nature relationship as given, but aim to study the interactions between 6th grade primary school children and their contexts, both at home and in school, for a better understanding of what factors have played a role in shaping their perceptions. Figure 1 illustrates the conceptual framework for analyzing the channels of influence from society via parents and schools on children's perceptions of human-nature relationship in China. We now turn to discuss the research questions and methods.

(Figure 1 is about here)

Figure 1. Conceptual framework for analyzing factors impacting children's perceptions of human-nature relationship in China



3. Research questions and methods

3.1 Research questions

The paper aims to answer the following three questions: (1) how do Chinese children perceive the human-nature relationship, (2) whether children's perceptions are correlated with that of their parents, and (3) whether environmental education in schools has made a difference. To answer the research questions, we adopted five items from the NEP for measuring perceptions of human-nature relationship for both children and their parents.

3.2 Instrument for measuring perceptions of human-nature relationship for both children and their parents

We selected item 1, 4, 10, 7, and 6 out of the modified NEP scale developed by Manoli, Johnson, and Dunlap in 2007 (see Table 1, they grouped the ten items into three categories according to factor analysis results). Those five items mainly reflect the two contrasting views toward the relationship between humans and nature, respecting nature for its own value and holding an instrumental view toward it. Especially, item number 6, "Nature is strong enough to handle the bad effects of our modern lifestyle" in the modified NEP scale (Manoli et al., 2007) has been combined together with item number 9, "The earth is like a spaceship with only limited room and resources" in the NEP scale first developed in 1978. We then created an item "Nature can provide limitless resources for humans to enjoy." This modification is aimed to highlight the instrumental view on nature. All five items, called the Human-Nature-Relationship (HNR) scale in the paper, were translated into Chinese and reworded in a way that is understandable for primary school children in China.

(Table 1 is about here)

Table 1. Human-nature-relationship (HNR) scale and Modified NEP scale for children

Dimension (by Manoli, Johnson and Dunlap, 2007)	Modified NEP scale for children* (by Manoli, Johnson and Dunlap, 2007)	Human-Nature-Relationship (HNR) Scale (by author)
Rights of nature	①Plants and animals have as much right as people to live.	DV1: We should cherish the lives of plants and animals
	④People must still obey the laws of nature.	DV2: Human beings have to obey the laws of nature
	⑦People are supposed to rule over the rest of nature.	DV4: Human beings can control nature
Human Exemptionalism	③People are clever enough to keep from ruining the earth.	
	⑥Nature is strong enough to handle the bad effects of our modern lifestyle.	DV5: Nature can provide limitless resources for human beings to enjoy
	⑨People will someday know enough about how nature works to be able to control it.	
Eco-Crisis	②There are too many (or almost too many) people on earth.	
	⑤When people mess with nature it has bad results.	
	⑧People are treating nature badly.	
	⑩If things don't change, we will have a big disaster in the environment soon.	DV3: Human beings damaging nature will lead to bad consequences

Source: Author compilation based on Table 2 (page 9) and Figure 2 (page 10) in Manoli, Johnson and Dunlap (2007).
Note: A child and his/her parents' scores on DV1-DV5 are dependent variables in the regression analysis.

3.3 Sample characteristics and data

We applied the HNR scale to 1,307 sixth-grade primary school children and their parents in Nanshan district, Shenzhen, China. Sample characteristics are reported in Table 2.

In 2009, Nanshan district had altogether 57 primary schools. Based on expert opinion, we divide them into 4 categories, A, B, C, and D with school quality in terms of teachers' qualifications and school facilities from the best to the worst in a descending order. The

distribution was the following, A: 8; B: 34; C: 10; D: 5. Then we randomly selected 3, 7, 3, and 3 schools from each category. Oversampling A, C, and D type schools was aimed to have a meaningful comparison between families who have access to those exceptionally "good" and "bad" schools. Two classes of the sixth grade were randomly selected in each participant school and all the students in both classes and their parents were invited to participate in the study. The response rate of the children survey was 99.62% and that of parents was 80.86% {Li, 2012 #1655}.

Children survey respondents were comprised of 704 (53.9%) boys and 603 (46.1%) girls. Among children who reported whether he/she is the only child at home, 554 (48.7%) had siblings, while 583 (51.3%) were only children.[1]

Parent survey respondents were comprised of 461 (44%) fathers and 587 (56%) mothers. Of them, 217 (25.8%) only had up to middle school education, 250 (29.8%) finished high school, and 372 (44.4%) obtained a university undergraduate degree or higher.

To understand the interactions between parents and children, participant children were also requested to report frequency of family discussion and activities and whether they traveled with parents in the summer of 2009. On average, a child discussed with his/her parents several times a month and less frequently than several times a week. Furthermore, 52.7% of the participant children travelled with their parents in the summer of 2009 (Table 2).

[1] Popularly referred as "one-child policy" started in 1979 in China, variation existed in the implementation as well as detailed policy design within provinces. For example, rural peasents are allowed to have a second child after the first child is 7 years old if the first is a daughter. Gu et al gave a very good overview of the population policy in China {Gu, 2007 #1608}.

Besides the variables on individual observations, we created a dummy variable to capture school features concerning environmental education. There were 4 green schools in the sample and 26.8% of the participant children were studying in those green schools.

All the survey respondents were requested to provide their demographic information and answer the five questions in the HNR scale (see Table 1). Using a 1-4 scale (1=Totally disagree; 2=Disagree; 3=Agree; 4=Totally agree), we forced the survey respondents to take a side and ruled out the option of no-opinion. Because there were two questions negatively worded, we recoded the values to make sure a higher score indicates a less anthropocentric view on nature. The total mean HNR scores for parents and children were 16.440 and 18.001, respectively.

(Table 2 is about here)

Table 2. Descriptive statistics, mean values of key variables from the survey, standard deviations in parentheses.

Variable	Description	Parent	Children
Male	1 = male	0.440	0.539
Income	Household income in 1,000 Yuan	11.850 (14.124)	
Basic education	1 = basic education (reference category)	0.258	
High school	1 = high school	0.298	
Higher education	1 = post high school degree up to master education	0.444	
Only child	1 = only child		0.513
Discuss with parents	1=Never; 2=Seldom; 3=Several times a month; 4=Several times a week; 5=Everyday		3.332 (0.846)
Travel	1 = traveled with parents in the summer of 2009		0.527
Green school	1 = green school		0.268

3.4 Methods for data analysis

The study aims to understand whether formal environmental education and parental influence have made any impact on children's views on human-nature relationship. Because China has a one-party rule system and state censorship, the Chinese public has to largely rely on informal chanles for expressing their political views. A Chinese' party affiliation does not necessarily reflect one's political views. And more than 70% of the survey respondents did not have any religious beliefs. Thus, we control for neither political views (party affiliation) nor religious beliefs for parents in the study. We expect that gender, household income, and educational attainment would matter for parents' environmental worldviews and thus we control for their effects in our analysis. For children, we expect parents' perceptions of human-nature relationship to have an impact on that of their children. Parents influence their preadolescents through parent-child interactions. Thus, we expect only child status and frequency of discussing issues with parents to have an impact on children's worldviews because only children usually receive more attention from and interact more with parents. Furthermore, extra-curricular activities such as traveling would broaden the horizon of children and may draw them closer to nature. And students from green schools are expected to perceive nature from a less anthropocentric point of view than those from non-green schools. Even though we are not clear whether gender would be an impacting factor for children on their perceptions of human-nature relationship, we also control for gender effect in the analysis.

We first did paired t-test to compare parents' and their children's scores on each of the five indicators of the HNR scale. Secondly, we conducted correlation analysis to identify whether there existed a possible intergenerational transmission of environmental worldviews from parents to children. Finally, a regression analysis was adopted to understand the impact of green schools and parents on children's perceptions of human-nature relationship.

4. Results

On average, children had significantly more pro-environmental attitudes than their parents because the results of the paired t-test were all statistically significant at 1% level (column 4, Table 3). But they were also positively correlated on all the five items (column 5, Table 3). The correlation did not reveal parent-child transmission of environmental worldviews on an individual basis. So we now adopt a regression analysis to examine impacting factors of children's perceptions of human-nature relationship.

(Table 3 is about here)

Table 3. Understanding environmental worldviews of both preadolescents and their parents[1]

Human-Nature-Relationship Scale	**Parent**	**Children**	**Paired t-test[2]**	**Correlation[3]**
We should cherish the lives of plants and animals (DV1)	3.699 (0.467)	3.840 (0.397)	0.000***	0.076**
Human beings have to obey the laws of nature (DV2)	3.474 (0.608)	3.570 (0.612)	0.000***	0.128***
Human beings damaging of nature will lead to bad consequences (DV3)	3.492 (0.673)	3.651 (0.715)	0.000***	0.141***
Human beings can control nature (DV4)	2.156 (0.879)	1.518 (0.827)	0.000***	0.205***

Nature can provide limitless resources for human beings to enjoy (DV5)	2.190 (0.988)	1.711 (1.020)	0.000***	0.256***

[1] Mean scores reported; standard deviations in parentheses; paired t-test and correlation analysis conducted.
[2] Absolute p-value of paired t-test is presented.
[3] Absolute value of pearson correlation coefficient is presented.
*, **, *** denote that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

To avoid confusion on the direction of effects of those impacting factors on environmental worldviews, we transformed DV4 and DV5, by (5 - DV4) and (5 - DV5) to measure level of disagreement with the question statements. Then bigger values on transformed DV4 and DV5 reflect more environmentally friendly worldviews as well as to maintain the same scale as the other three dependent variables. We run separate regression analyses on the five dependent variables for both children and their parents to find significant impacting factors of their environmental worldviews. Regression results are reported in Table 4.

To what extent a child agreed we should cherish the lives of plants and animals (DV1) was positively associated with his/her parents' views and discussing with parents, but negatively associated with household per capita income. Attending green school or travelling with parents was not associated with a child's attitudes toward plants and animals (column 3, Table 4). Comparing with parents who only had up to high school education, those who had completed bachelor degree or above tended to agree more with the idea of cherishing the lives of plants and animals (column 2, Table 4).

On whether human beings have to obey the laws of nature (DV2), a child tended to agree more if he/she attended a green school, discussed with parents, or had parents who also agree

(column 5, Table 4). For parents, their per capita household income and higher education experiences enhanced their level of agreement with human beings' obeying the laws of nature (column 4, Table 4).

How much a child agreed that human beings damaging nature will lead to bad consequences (DV3) was positively associated with his/her travelling experiences but all the other factors did not have an impact (column 7, Table 4). Again, having obtained a bachelor degree or above significantly increased a parent's level of agreement with the statement (column 6, Table 4).

(Table 4 is about here)

Table 4. Human-Nature-Relationship regressions for both child and her/his parent; absolute value of z statistics in parentheses

	DV1	DV1	DV2	DV2	DV3	DV3	DV4 (transformed)	DV4 (transformed)	DV5 (transformed)	DV5 (transformed)
	Parent	Child	Parent	Child	Parent	Child	Parent	Child	Parent	Child
pmale	0.090		0.188		-0.374		-0.304		-0.701	
	(0.47)		(0.77)		(1.42)		(0.82)		(1.65)*	
incomes	-0.001	-0.002	0.005	-0.004	0.002	0.001	-0.000	-0.001	-0.000	0.000
	(0.40)	(2.11)**	(3.11)***	(1.59)	(1.18)	(0.27)	(0.01)	(0.64)	(0.05)	(0.11)
highschool	-0.031		-0.037		0.068		-0.110		0.201	
	(0.77)		(0.73)		(1.15)		(1.29)		(2.34)**	
higheredu	0.103		0.156		0.238		0.042		0.472	
	(2.27)**		(2.66)***		(3.65)***		(0.48)		(4.52)***	
cmale		-0.052		-0.001		-0.072		0.001		-0.033
		(1.98)**		(0.02)		(1.69)*		(0.01)		(0.51)
onlychild		-0.002		-0.020		0.035		0.120		0.202
		(0.05)		(0.41)		(0.64)		(1.53)		(1.96)**
ctravel		-0.002		0.053		0.118		0.007		0.013
		(0.06)		(1.08)		(2.14)**		(0.09)		(0.17)
greens		0.013		0.098		-0.001		0.125		0.108
		(0.43)		(1.81)*		(0.03)		(1.86)*		(1.37)
discuss		0.067		0.063		0.039		-0.008		0.001
		(3.44)***		(2.28)**		(1.29)		(0.19)		(0.02)
pj1		0.484								
		(1.67)*								
pj2				0.641						
				(2.01)**						
pj3						0.349				
						(1.26)				
npj4								0.553		
								(0.90)		
npj5										0.705
										(2.75)***
Constant	3.647	1.881	3.297	1.119	3.544	2.302	3.001	1.863	2.865	1.220
	(34.36)***	(1.82)*	(24.29)***	(1.05)	(23.98)***	(2.61)***	(14.56)***	(1.06)	(12.11)***	(1.90)*
Observations	825	825	825	825	825	825	825	825	825	825

*, **, *** denote that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

When asked about whether human beings can control nature (DV4), a child who was attending a green school significantly disagreed more than those attending non-green schools. However, all the other factors did not affect a child's view on this (column 9, Table 4). And none of the demographic, socio-economic, or educational backgrounds had an impact on parents' attitude toward whether human beings can control nature (column 8, Table 4).

The last statement was *nature can provide limitless resources for human beings to enjoy* (DV5). A child who was the only child at home tended to disagree more than those who had siblings. Again, a child's view on the statement was positively associated with that of his/her parent (column 11, Table 4). Parents who had either high school or university education tended to disagree more with the statement than those who only had primary or middle school education (column 10, Table 4).

Apparently, green schools instilled the concept of that humans do not rule over nature among the preadolescents in China. That is to say, compared with others, children who were attending green school agreed more that human beings have to obey the laws of nature and disagreed more with the view that human beings can control nature. It illustrated that the green schools have had some success in transmitting principles. The other three aspects of human-nature-relationship (human beings have to obey the laws of nature, human beings damaging nature will lead to bad consequences, and nature can provide limitless resources for human beings to enjoy) were less abstract and can be more easily experienced in a child's daily life. Green school seemed not to have significant

impact on a child's views on those three aspects. Discussing with parents enhanced a child's understanding of cherishing lives of plants and animals. Travelling with parents enhanced a child's understanding of human beings damaging of nature will lead to bad consequences. But neither attending green school nor conversing with parents helped them understand better whether nature can provide limitless resources for human beings to enjoy.

For parents, obtaining higher education was positively associated with their views on four of the aspects of human-nature relationship, except for whether human beings can control nature. We shall discuss this more in the next section. Gender or household income did not have much impact on parents' environmental worldviews. Furthermore, a chi-square analysis was conducted to compare the aggregated mean HNR scores of parents with basic education, up to high school education, and up to bachelor and past-graduate degrees. Table 5 illustrates that the better a parent was educated, the higher HNR score he / she got. And the correlation between parents' educational attainment and their HNR scores was statistically significant.

(Table 5 is about here)

Table 5. Correlation between parents' education level and HNR scores

Parents' education level	Mean HNR score	Pearson correlation
Up to middle school education	15.861 (2.264)	Correlation coefficient = 0.233 p-value = 0.000***
High school	16 (2.131)	
University education or above	17.041 (2.058)	

*, **, *** denote that the coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively.

5. Conclusions and discussion

From the above analysis, we conclude: (1) higher education is associated with adults' perceiving nature in a more environmentally friendly way, as defined by our questionnaire items adapted from NEP scales; (2) effects of higher education on parents' environmental worldviews have been transmitted to their children; and (3) environmental education nurtures environmentally friendly worldviews, especially, that there is no human supremacy over nature among those preadolescents. Thus, this study provides evidence for the importance of education in general and environmental education in particular in cultivating appreciation of nature and changing worldviews from more anthropocentric to more eco-centric. Why could higher education and environmental education accomplish so much?

The Belgrade Charter (1975) prescribed the goal of environmental education as working to "develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones." Environmental education brings hope to solve environmental problems by increasing environmental awareness, disseminating environmental knowledge, stimulating environmental commitments, and promoting environmentally friendly behaviors (Leal Filho et al., 1996).

In 1996, the National Commission on the Education of China defined the domain of environmental education to include environmental scientific knowledge, environmental laws and regulations, and environmental ethics. Furthermore, primary and middle schools were encouraged to engage students in building green campuses and to develop extra-curriculum activities such as summer / winter camps and essay competitions to instill environmental education in various school activities. Furthermore, starting in 2000, the title of Green School has been awarded to schools that have done the following for their green school initiative: (1) setting up a leading group, (2) developing an action plan, (3) making available financial and technical support, (4) reducing garbage, (5) saving energy and resources, (6) documenting activities and efforts taken, (7) instilling environmental concerns in subject matters, (8) promoting teachers' participation in environmental continuing education, (9) communicating and creating an environmentally friendly campus atmosphere, (10) advocating for an environmentally friendly life style, (11) improving campus environmental quality, and (12) encouraging student body participation in school environmental management (National Environmental Protection Administration et al., 1996). Bogner found outdoor education experiences of sufficient duration helped shape adolescents' preferences towards the environment and nature (Bogner, 2002). Presumably, with the above arrangements by green schools, students who study there would enjoy green space, participate in nature and resource conservation activities, learn environmental knowledge, and take part in solving environmental problems. Consequently, they could become more environmentally conscious than those who do not study in green schools.

Furthermore, even though there were no general education courses on the environment in the 1990s when these children's parents were studying in higher education institutions, there are two compulsory university courses, one on Marxism and the other one on General Dialectics of Nature. The General Dialectics of Nature introduces students to worldviews on nature, science, technology, and methods for scientific inquiries. It describes the world as material, dynamic, and inter-connected. People have to make sure the natural system is sustainable. But production in capitalist societies breaks the balance between man and nature. In essence, both courses argue for laws that are beyond the control of human beings that exercise their power over human society. However, in the 1960s and 1970s, the dominant development practices then were conquering nature, as called for by Chairman Mao (Shapiro, 2001). The participant parents in the study were in their late thirties and forties in 2009 and they had grown up in those two decades. Whether they were able to attend a university or not, those parents were similarly exposed to the dominant ideology in Chinese society. Probably that explained why we could not find a significant impact of higher education on parents' views on whether human beings can control nature, compared to those parents who did not receive higher education.

Marking the period when environmental problems became global concerns, the course syllabus for General Dialectics of Nature was updated in 2001 to emphasize that human beings coexist with other creatures in the ecological system. It promoted an "ecological worldview on nature." More specifically, the following contents were added, (1) why

man and nature are perceived to be in conflict with each other, (2) how ecology, modern science, and technology are the foundations for achieving harmony between man and nature, and (3) why sustainable development strategies are necessary for achieving harmony between man and nature.

Not surprisingly, university students who have studied both courses have been exposed to the ecological worldview on nature and may think critically about human-nature relationship, which may favor more of an eco-centric point of view. Thus, university students are a group of people who have above average levels of environmental awareness and have been actively engaged in environmental protection. For example, by October 2008, there were altogether 3,539 nonprofit environmental organizations (including Hong Kong, Macao, and Taiwan), of which 1,382 were formed by college students (All China Environmental Federation, 2008) (page 3).

In addition, we found 63.16% of only children travelled with their parents in the summer of 2009, which is statistically significantly higher than the only 39.85% of children with siblings who travelled. Participant parents who have only one child were better educated, had higher household income, and spent more time discussing and doing activities together with their children, than their counterparts who have more than one child. The socialization processes at home might be able to partially explain why the high HNR scores of children are positively associated with that of their parents.

With environmental issues becoming more urgent and prominent, universities paying more attention to general education, and increasing inequality in university enrollment rates of children from different economic classes (Chan and Zhang, 1999; Knight and Rosa, 2011; Whyte, 2010), we expect higher education and associated environmentally friendly worldviews will be reproduced among younger generations from relatively well-off families. If that is the case, environmental education in primary and middle schools will become even more important for nurturing environmental worldviews for all children in Chinese society. Green schools have exhibited positive effects on forming a more eco-centric view toward nature, which provides empirical support for making enhanced environmental education accessible for every child in China, not only for those who study in green schools.

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References

Adara, O.A., 1996. Impact of an outdoor educational strategy on teacher profile in environmental education. International Journal of Educational Development 16(3), 309-317.

All China Environmental Federation, 2008. Report on the Development of Non-Governmental Environmental Organizations in China 中国环保民间组织发展状况报告. All China Environment Federation, Beijing.

Bekalo, S., Bangay, C., 2002. Towards effective environmental education in Ethiopia: problems and prospects in responding to the environment-poverty challenge. International Journal of Educational Development 22(1), 35-46.

Blum, N., 2008. Environmental education in Costa Rica: Building a framework for sustainable development? International Journal of Educational Development 28(3), 348-358.

Boeve-de Pauw, J., Donche, V., Van Petegem, P., 2011. Adolescents' environmental worldview and personality: An explorative study. Journal of Environmental Psychology 31(2), 109-117.

Bogner, F.X., 2002. The Influence of a Residential Outdoor Education Programme to Pupil's Environmental Perception. European Journal of Psychology of Education 17(1), 19-34.

Chan, K.W., Zhang, L., 1999. The Hukou System and Rural-Urban Migration in China: Processes and Changes. China Quarterly(160), 818-855.

Dietz, T., Stern, P.C., Guagnano, G.A., 1998. Social structural and social psychological bases of environmental concern. Environment and Behavior 30(4), 450-471.

Dunlap, R., E. , Van Liere, K., D. , Mertig, A., G. , Jones, R.E., 2000. Measuring endorsement of the new ecological paradism: A revised NEP scale. The Journal of Social Issues 56(3), 425-442.

Dunlap, R.E., 2008. The New Environmental Paradigm Scale: From Marginality to Worldwide Use. The Journal of Environmental Education 40(1), 3-18.

Dunlap, R.E., Van Liere, K.D., 1978. The 'New Environmental Paradigm': A Proposed Measuring Instrument and Preliminary Results. Journal of Environmental Education 9(4), 10-19.

Dunlap, R.E., Van Liere, K.D., 1984. Commitment to the Dominant Social Paradigm and Concern for Environmental Quality. Social Science Quarterly 65(4), 1013-1028.

Gottlieb, D., Vigoda-Gadot, E., Haim, A., Kissinger, M., 2012. The ecological footprint as an educational tool for sustainability: A case study analysis in an Israeli public high school. International Journal of Educational Development 32(1), 193-200.

Hawcroft, L.J., Milfont, T.L., 2010. The use (and abuse) of the new environmental paradigm scale over the last 30 years: A meta-analysis. Journal of Environmental Psychology 30(2), 143-158.

Hong, D., 2005. Environmental awareness of Chinese urban residents. Jiangsu Social Sciences 2005(1), 127-132.

Hong, D., 2006. Measurement of environmental concern: Application of the NEP scale in China. Society 26, 71-92.

Johnson, C.Y., Bowker, J.M., Cordell, H., 2004. Ethnic Variation in Environmental Belief and Behavior. An Examination of the New Ecological Paradigm in a Social Psychological Context. Environment & Behavior 36(2), 157-186.

Knight, K.W., Rosa, E.A., 2011. The environmental efficiency of well-being: A cross-national analysis. Social Science Research 40(3), 931-949.

Leal Filho, W., Murphy, Z., O'Loan, K., Unesco-UNEP International Environmental Education Programme., 1996. A sourcebook for environmental education : a practical review based on the Belgrade Charter. Parthenon Pub. Group, New York.

Li, Y., 2006. A Comparative Study on Ecotourists' Behavior and Attitude Both at Home and Abroad - A Case Study of Baihuashan Nature Reserve in Beijing. Tourism Tribune(21), 75-80.

Li, Y., 2009. Analyzing the model of ecotourists cultivation from the interaction among EI, NEP and VIS. Geographical Research 28(6), 1572-1582.

Liu, J., Ouyang, Z., Miao, H., 2010. Environmental attitudes of stakeholders and their perceptions regarding protected area-community conflicts: A case study in China. Journal of Environmental Management 91(11), 2254-2262.

Luo, Y., Luo, X.J., Lin, Z., Chen, S.J., Liu, J., Mai, B.X., Yang, Z.Y., 2009. Polybrominated diphenyl ethers in road and farmland soils from an e-waste recycling region in Southern China: Concentrations, source profiles, and potential dispersion and deposition. Science of the Total Environment 407(3), 1105-1113.

Manoli, C.C., Johnson, B., Dunlap, R.E., 2007. Assessing Children's Environmental Worldviews: Modifying and Validating the New Ecological Paradigm Scale for Use With Children. The Journal of Environmental Education 38(4), 3-13.

National Commission on Education, 1992. National Commission on Education Issued "Guidelines on study plans for primary and middle schools in the nine-year compulsory education system (for trial implementation)" and "Teaching guidelines on the 24 subject matters (for trial implementation), in: Education, N.C.o. (Ed.).National Environmental Protection Administration, National Commission on Education, Propaganda Department of the Chinese Communist Party, 1996. Action plan for national environmental propaganda and education (1996-2010).

Nomura, K., 2009. A perspective on education for sustainable development: Historical development of environmental education in Indonesia. International Journal of Educational Development 29(6), 621-627.

Nooney, J.G., Woodrum, E., Hoban, T.J., Clifford, W.B., 2003. Environmental worldview and behavior: Consequences of dimensionality in a survey of North Carolinians. Environment & Behavior 35(6), 763-783.

Olli, E., Grendstad, G., Wollebaek, D., 2001. Correlates of Environmental Behaviors. Bringing Back Social Context. Environment & Behavior 33(2), 181-208.

Peterson, M.N., Liu, J., 2008. Impacts of Religion on Environmental Worldviews: The Teton Valley Case. Society & Natural Resources 21(8), 704-718.

Shapiro, J., 2001. Mao's war against nature : politics and the environment in Revolutionary China. Cambridge University Press, Cambridge ; New York.

Taskin, O., 2009. The Environmental Attitudes of Turkish Senior High School Students in the Context of Postmaterialism and the New Environmental Paradigm. International Journal of Science Education 31(4), 481-502.

Tsai, W.-T., 2012. An investigation of Taiwan's education regulations and policies for pursuing environmental sustainability. International Journal of Educational Development 32(2), 359-365.

UNESCO, 1997. Educating for a sustainable future: A transdisciplinary vision for concerted action, International Conference on Environment and Society: Education and Public Awareness for Sustainability. UNESCO, Thessalonilki.

van Petegem, P., Blieck, A., 2006. The environmental worldview of children: a cross-cultural perspective. Environmental Education Research 12(5), 625-635.

Whyte, M.K., 2010. One country, two societies : rural-urban inequality in contemporary China. Harvard University Press, Cambridge, Mass.