Green Transformation of Industry: Matching Knowledge to Deeds?

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Abstract

The key to promote the green transformation of industry lies in the coordination of individual environmental knowledge and environmental behavior. Based on a random survey in China, this paper takes Chinese university students as research samples, and investigates the characteristics and relationship between environmental knowledge and pro-environmental behaviors. We found that on average 76.2% university students have mastered the environmental knowledge well. Among them, the average degree of mastery of common environmental knowledge (84.4%) is much higher than their mastery of professional environmental knowledge (43.4%). Although the students' environmental knowledge was good, we also found that good environmental knowledge is not always consistent with active environmental behavior. More than 31.7% university students with good environmental knowledge are less likely to conduct active environmental behavior. Environmental behavior in the private sphere (27.42%) is more likely to be occurred than the environmental behaviors in the public domain (4.89%). Furthermore, we found that the positive effect of good environmental knowledge on pro-environment behaviors will appear after controlling the moderating effects of social trust and environmental regulation. This paper sheds light on the coordination of university students' environmental knowledge and environmental behavior to gain the harmony between humankind and nature.

Keywords

Environmental Knowledge; Environmental Behaviors; University Students.

1. Introduction

In recent years, with the rapid development of China's economy, the consumption of environmental resource has been aggravated, and the environmental issues are getting more and more serious. The environmental problem is not merely a problem of economic development, but also a reflection of social driving forces of environmental protection. Environmental regulation is regarded as an important way to preserve the ecological environment and improve the environmental problems (Porter, 1995)[1]. However, environmental protection should not merely rely on the government and environmental protection enterprises, but also need to motivate more people to participate in the environmental knowledge and environmental protection behaviors.

Environmental education is thought to be crucial in popularizing and cultivating the publicenvironmental awareness, the environmental knowledge and skills, and ultimately the environmental behaviors and the green transformation of industry. It is also becoming more and more important to set up environmental educational courses and environmental protection activities in schools. It is a kind of educational activity based on the relationship between human being and

ecological environment. Under the background of knowledge economy, it is obliged to pay more attention to the active role of university students on China's sustainable development. As university students are the masters of the future society and the mainstay of social action, their understanding of the environment protection will determine the development trend of the future society. Therefore, cultivating students' environmental awareness and environmental protection capability is the primary task of environmental education. The main goal of environmental education is to help people to better understand the impact of ecological environment on human beings' sustainable development and the severe situation of environmental crisis, and thus to improve their environmental awareness and cultivate their sustainable environmental behaviors.

Numerous literatures have been developed to assess students' environmental knowledge and attitudes by a questionnaire or various models, investigate the relationship between environmental education and environmental knowledge, attitudes and behaviors, and illuminate the influences of background factors on the students' environmental literacy (Meinhold and Malkus, 2005[2]; Pe'er et al., 2007[3]; Levine, 2012[4]; Otto and Pensini, 2017[5]). Results indicated significant differences in both knowledge gain and attitudes of students after they have completed the environmental science course or accepted any other kinds of environmental education. The environmental education and environmental knowledge are positively correlated with their environmental behaviors (Bradley et al., 1999[6]; Zsóka et al., 2013[7]). Some argue that the effects of environmental education on pro-environmental behaviors are valid in some certain circumstances (Kuhlemeier et al., 1999[8]). Demographic factors, external factors and internal factors may probably influence the pro-environmental behaviors (Kollmuss and Agyeman, 2002[9]). The question of what shapes pro-environmental behavior is such a complex one that it cannot be explained through one single framework or diagram. Furthermore, some literatures throw light upon the gaps between the environmental knowledge and pro-environmental behavior (Duerden and Witt, 2010[10]).

Although many studies have been undertaken, no definitive explanation has yet been found. Taking all these into consideration, there are few related studies analyzed the current situation and relationship of environmental knowledge and pro-environmental behaviors of university students in the context of China. Accordingly, we propose our own analytical frameworks based on the existing work and enrich relevant research areas. We explored the current situation of Chinese university students' environmental education, environmental knowledge and environmental behavior. We found the contradictory phenomenon of high environmental knowledge and indifferent environmental behaviors. Furthermore, we discussed the relationship between environmental knowledge and environmental behaviors, and tried to investigate the moderating effect of social trust and government's environmental regulation. Finally, we put forward some proposals to optimize the role of environmental education from the perspective of enhancing the sense of social trust and strengthening the government's supervision of environmental protection. It has important guiding significances for promoting the environmental education performances of young Chinese, and also has important theoretical and practical significance for the dual goal of ecological civilization and green growth.

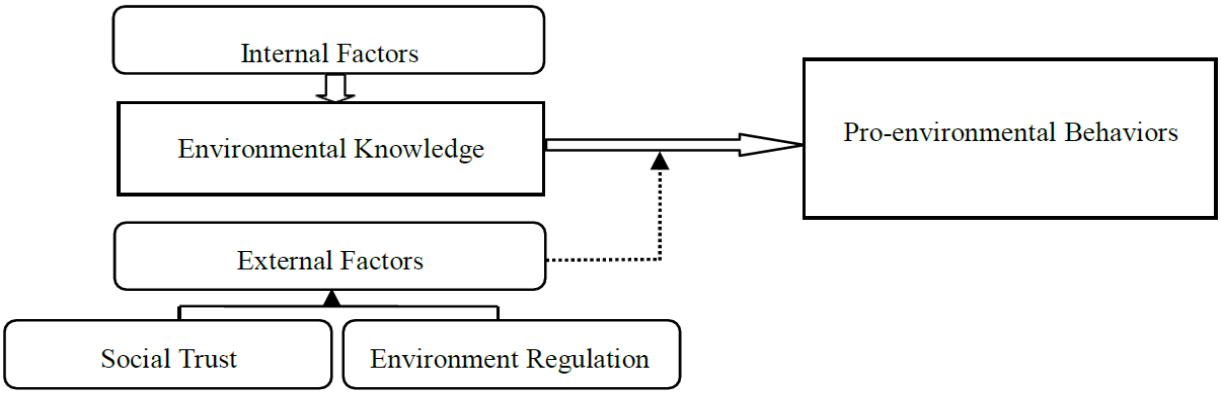

Figure 1. Relationship between environmental knowledge and pro-environmental behaviors

2. Samples and Methods

Our paper was studied in a nationwide sample of more than 221 students from different universities in China. We applied the correlational survey method in our research. In the present study, the random sample of the study consisted of 221 university students from all over China in the 2013 Chinese General Social Survey (CGSS). It is the national representative continuous survey project conducted by of the Renmin University of China. We select the effective sample size of 221 university students in China, which covering their basic information, environmental attitude and environmental behaviors. The sampling design used multi-stage stratified design.

In China, environmental education has started since the primary school stage to equipmentstudents with prerequisite skills for further learning. University students will take the environmental education courses in various forms, which including the professional environment education and the general environment education. Professional environmental educationsuch as the course of environmental science and environmental engineeringaims to cultivate environmental management professionals of environmental protection. Meanwhile, general environmental education refers to all those professional and interdisciplinary popularization of environmental education courses. They are targeting at environmental ethics to cultivate students' ecological awareness and encourage environmental behaviors, which including topics of the environmental issues such as environmental pollution and energy resources utilization.

3. Analysis and Findings

The results of university students' environmental awareness or environmental consciousness are shown in Table 1. Only 3.62% of the interviewed students would choose environmental issue as the most important to be solved in social problems. 9.50% choose it as the second most important, and 12.22% as the third most important. Altogether the proportion of interviewed students who choose environmental issue as the top three important to be solved in social problems were accounted for 25.34%. Statistics show that the sense of environmental protection of university students are not very strong and are more inclined to attach importance to it.

Table 1.Whether environmental problems are the most important to be solved in social problems

order	the most important	the second most important	the third most important	top 3 most important
ratio(%)	3.62	9.50	12.22	25.34

3.1 Environmental Knowledge

The results of university students' environmental knowledge are shown in Table 2. University students were found to be more knowledgeable about the environmental pollution problems in daily life, such as the air pollution, water pollution, noise pollution and waste pollution. In comparison, they are not sensitive enough to environmental problems that are far from their daily life, such as the degradation of land, reducing wildlife and desertification. This reveals that their cognition towards the environment is imbalanced, which is limited to the surrounding natural environment while negligence of the global environmental knowledge.

Table 2.Don't know about the following types of environmental issues

issues	air pollution	water pollution	noise pollution	industrial waste pollution	domestic waste pollution	insufficient green space
ratio(%)	4.07	4.52	5.88	11.76	5.88	9.95
issues	destruction of forest	degradation of land	shortage of fresh water	food pollution	desertification	reducing wildlife
ratio(%)	13.12	19.46	11.76	10.86	20.81	18.55

More specifically, Table 3 describes the choice of environmental knowledge of interviewed university students. Statistics indicates that the degree of mastery of common environmental knowledge is much higher than that of the professional environmental knowledge. University students' high awareness of environmental protection is mainly concentrated in the family life level, such as classification of domestic waste, saving water, oil, gas, electricity and other energy or fuel. However, when asked the question "In the report of water pollution, water quality of grade V (5) means better than that of grade I (1)", more than 63.8% of the interviewees choose the wrong answers or don't knows. Again this confirmed the imbalance of the environmental knowledge among Chinese university students. They were more knowledgeable about the common sense than professional knowledge of environmental protection. From the above, the students' knowledge about environmental problems was fragmentary and often incorrect. Additionally, the environmentally responsible behavior of many of the students was inadequate.

Table 3. Knowledge of environmental protection (%)

Questions of environmental knowledge	answer right	answer wrong	answer don't know	wrong or don't know
Car exhaust does not pose a threat to human health.	89.59	9.05	1.36	10.41
Excessive use of chemical fertilizers and pesticides can cause environmental damage.	89.59	7.69	2.71	10.4

3.2 Environmental Behavior

Table 4 shows the results of university students' environmental behavior. On the whole, 41.08% of the interviewees have never conducted the listed environmental behaviors, and 42.77% are occasionally, and 16.16% are often, respectively. In comparison, the proportion of the frequency of the environmental behavior showed significant difference between the personal environmental behavior and public environmental behavior. 19.27% of the interviewees have never conducted the personal environmental behavior, while 62.89% have never conducted the public environmental behavior. 53.31% of the interviewees have occasionally conducted the personal environmental behavior, while 32.22% have occasionally conducted the public environmental behavior. 27.42% of the interviewees have often conducted the personal environmental behavior, while 4.89% have often conducted the public environmental behavior. The proportion of interviewees who often conducted the public environmental behavior isrelatively small. This shows that public awareness and social participation levels of environmental protection is relatively low in public fields.

Table 4.Environmental behaviors during the recent year (%)

	never	occasion	often
Environmental Behaviors	41.08	42.77	16.16
Personal environmental behavior	19.27	53.31	27.42
Categorization of garbage.	22.17	56.11	21.72
Discuss environmental issues with relatives and friends.	25.79	62.90	11.31
Use one's own shopping basket or bag when purchasing daily necessities.	20.36	45.25	34.39
Repeating use of plastic bags.	8.14	39.37	52.49
Attention to environmental information from radio, television and newspapers.	19.91	62.90	17.19
Public environmental behavior	62.89	32.22	4.89
Donation for environmental protection.	55.2	41.63	3.17
Active participation in the environmental publicity and education activities held by government and organization.	47.96	43.44	8.60
Active participation in environmental protection activities organized by private environmental protection groups.	55.20	41.18	3.62
Maintenance of forest or green space.	79.64	15.38	4.98
Active participation in complaints and appeals to solve environmental problems.	76.47	19.46	4.07

In addition to the differences in environmental knowledge and environmental behavior respectively, we also find the separation of environmental knowledge and environmental behavior. Interviewees with more environmental knowledge would probably be less active in environmental behaviors (as shown in Figure 2). This shows that university students are more inclined to incorporate their environmental knowledge advantage into the environmental protection. Besides, the interviewees will be more likely to participate in personal environmental activities than the public environmental activities (as shown in Figure 3 and Figure 4), which means that university students' enthusiasm for participation in public environmental protection is not satisfactory.

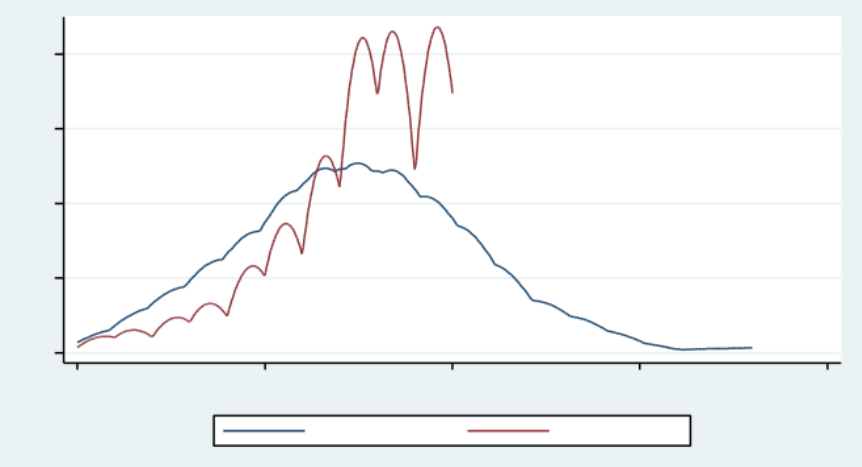

Figure 2.Kernel Density Curve of Environmental Knowledge and Environmental Behavior

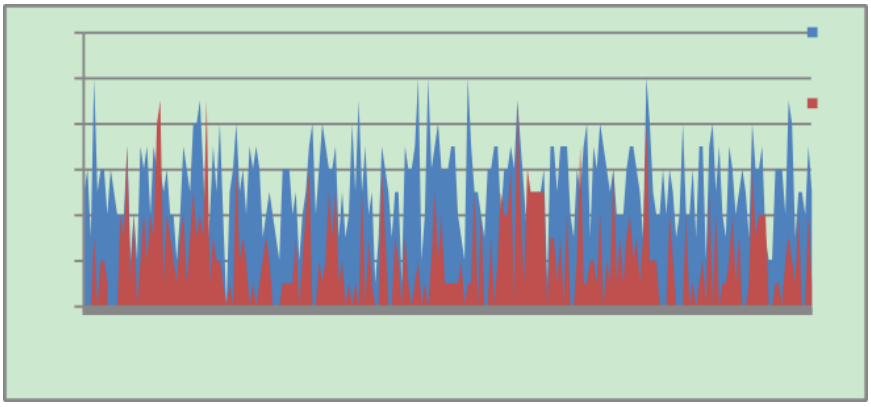

Figure 3.Dynamics of Private Environmental Behavior and Public Environmental Behavior

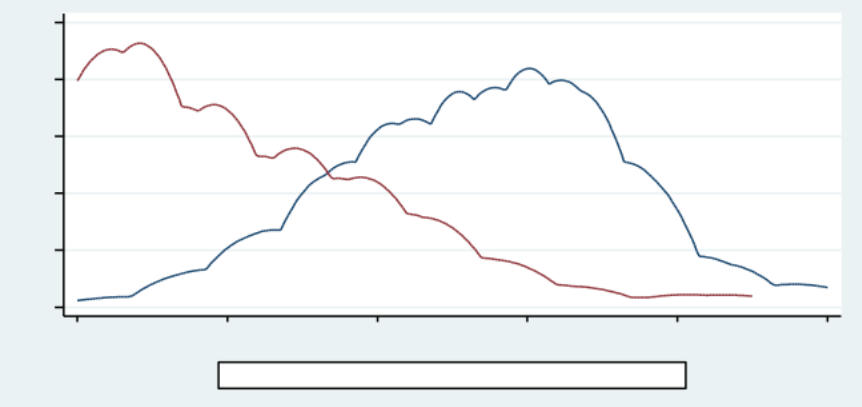

Figure 4.Kernel Density Curve of Private Environmental Behavior and Public Environmental Behavior

A possible explanation to this paradox might be that university students with differentindividual characteristics tend to implement a distinctive environmental behavior to meet with their environmental ethics. Those who chase the lowest cost of environmental protection will consider more on personal convenience and individual economic benefits rather than the public welfare. Due to its own disclaimer, individuals with strong personal interest impulse tend to dispose of responsibility to the society and have weak willingness to make personal sacrifices for environmentally responsible behavior. This is the main reason for the inversion of environmental knowledge and behavior, which is not conducive to stimulate the role of environmental education.

According to the above analysis, it can be found that there are some differences between our college students' environmental awareness and environmental protection behavior. Public environmental behavior reflects the characteristics of "no practice" and "knowledge and behavior are different" to a certain extent, which is basically the same with some existing studies.

3.3 Correlation Analysis

Furthermore, we studied the relationships among environmental behaviors and knowledge of university students. As shown in Table 5 and Table 6, a positive but insignificant correlation was found between the environmental knowledge and environmental behaviors of the students. In other words, Environmental knowledge was not significantly related to environmental behaviors. Students who were more knowledgeable in fields related to the environment had not shown more environment-oriented behaviors in comparison with others with lower knowledge scores.

Table 5. Correlation analysis results

Explanatory variables	Pearson correlation	Sig.(2-tailed)	N
EK	0.010	0.888	221
SC	0.120	0.077	221
ER	0.189	0.005	221

Explained variable: Environmental Behaviors

Table 6. Multivariate regression analysis results

	environmental behavior			
EK	0.014 (0.097)	0.011 (0.094)	0.087 (0.101)	0.201* (0.124)
SC		0.746* (0.416)		3.572** (1.471)
ER			1.409** (0.551)	0.166 (1.732)
controlled: EK×SC	YES	YES	YES	YES
controlled: EK×ER	YES	YES	YES	YES
N	221	221	221	221

Notes: The t statistic value is in brackets.

In addition, we want to know whether some background factors will influence or regulate the relationship between environmental knowledge and environmental behaviors. Consistent with existing theories [11], we introduce variables such as social capital and environmental regulation. We found that both the social capital (SC) characterized by trust and environmental regulation(ER) have significantly moderating effects on the relationship between the environmental knowledge and environmental behaviors.

This study further employed a mixed-methods design to examine the relationship between environmental knowledge and environmental behavior associated with environmental education. Survey data from 221 participant and comparison group members were analyzed to test our hypotheses. Additionally, qualitative data were analyzed to assess participants' perceptions of

environment areas. The findings indicate that environmental knowledge increased more than environmental behaviors whereas the private environmental fields are more favorable than public environmental fields. Further, while environmental knowledge did not synchronize with behavior, external factors such as social capital and environmental regulation would be likely to regulate the relationships between environmental knowledge and behaviors. A synthesis of the findings suggests that the synergistic governance of environmental protection catalyzed environmental knowledge into a stronger motivating force for the environmental behaviors.

4. Conclusion

Using a random survey of Chinese university students, this paper analyzes the current situations and relationship between their environmental knowledge and behaviors. We found that both the environmental knowledge and behaviors of university students were not sufficient. Additionally, we find a dilemma that higher environmental knowledge coexists with lower probability of pro-environmental behavior. This paper further analyzes the causes of thisphenomenon from the view of cognitive strategies and psychological balance, and finds that social responsibility and government's environmental regulation will mediated the influence of environmental knowledge on pro-environmental behaviors when their behaviors do not conform to their environmental standards and rules. This research suggests that knowledge about the environment and perfect external environment influence behavior through different pathways, which may have implications for interventions seeking to increase environmentally friendly behavior. These findings offer important insights for both theory and practice related to the research fields of environmental knowledge and behaviors. Accordingly, this article proposes the following countermeasures for matching knowledge to deeds.

First, it is essential to improve the teaching quality of environmental courses and cultivate university students' ecological consciousness. Speed up the legislation of local environmental education laws and regulations. Strengthen the guidance on the demand forecast, professional setting, teaching material construction, teacher team, school-enterprisecooperation and so on. Promote education syllabus and implementation guidelines for environmental education. Introduce the content of environmental protection and ecological civilization into the classroom and textbooks. Carry out a nationally unified environmental professional qualification certificate system, improve the evaluation system of environmental technical skills and standards of environmental occupational posts, and improve the professional level of environmental educators.

Second, we need to enrich the contents and forms of environmental education. Strengthen the practice and teaching of environmental majors, and cultivate research-oriented and applied-oriented talents according to their characteristics. Set up more courses of environmental protection and construct online courses for environmental protection. Strengthen the training of teachers in environmental education and encourage various extracurricular activities in environmental education. Actively support students in environmental protection social practice.

Third, it is necessary to establish a multiple cooperative governance system and strengthen the awareness of environmental rules. The coordinated cultivation of social responsibility and implementation of environmental rules is conducive to more active environmental knowledge learning and environmental protection behaviors. On one hand, different environmental regulation policies or tools should be selected through the command and control regulations by legal coercion to the polluters. For pollution limits or reduction standards enacted by governments, polluters must abide by the rules and regulations. Otherwise they will be subject to legal or administrative penalties. On the other hand, incentive environmental regulations such as subsidies, tax reduction or fund support are alternative means. The incentive regulation emphasizes the synergetic participation of public by flexible, market-oriented and incentive-based control strategy and enhances their welfares. The government and social environmental protection organizations should further enhance the publicity and popularization of environmental regulations, integrate environmental education into families, schools and other social subjects, cultivate public awareness of ecological civilization, and establish ecological civilization.

Acknowledgments

This research work is supported by Soft Science Project of Guangdong Province (2019A101002060), Natural Science Foundation of Guangdong Province (2019A1515011581), Philosophy and Social Sciences Planning Project of Guangdong Province (GD20SQ12), Guangzhou Philosophy and Social Science Planning Project (2020GZYB42, 2020GZGJ158), Educational Science Planning Project of Guangdong Province (2019GXJK079), and Special scientific research project for the prevention and control of COVID-19 of Department of Education of Guangdong Province (2020KZDZX1152).

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