



Cognition and Management Methods of Marine Environmental Protection in China Based on Cognitive Neuroscience

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ABSTRACT

Cognition is a kind of advanced neural activity that can reflect the reality. The cognition of marine environmental protection is a special brain activity that aims at marine environmental protection. Based on this, this paper starts from the four perspectives of marine environmental cognition, designs questionnaires which are distributed to college students in Shandong Province, and then summarizes the survey results. And this paper discusses the cognition degree of marine environmental protection of contemporary college students in China from the perspective of neuroscience. On this basis, this paper points out the existing problems and puts forward policy suggestions for management methods of China's marine environmental protection.

Key Words: Marine Environmental Protection, Marine Environmental Cognition, Brain, Questionnaire Survey

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Introduction

Cognition is the overall activity state of the brain. It is the "activity state" of the brain that can interact with the environment to form a psychological phenomenon (Potera, 2006; Hedden and Gabrieli, 2004). Cognition is an intrinsic property of brain activity and the essential function of brain activity is to generate cognition (Pham, 1997). Cognition evolves as the brain evolves and it is the cause of brain evolution (Mufson *et al.*, 2003). Some scholars believe that cognition represents the process of multiple brain changes whether we can clearly know that these changes will occur or not (Schacter *et al.*, 1998). Cognition is a kind of advanced neural activity that can reflect the reality (Schacter and Addis, 2007). Based on this, the cognition of marine environmental protection also reflects the process of human brain changes.

Since the industrial revolution, the economy of various countries around the world has begun to develop rapidly and humans have begun to excavate various natural resources (Kiatmura *et al.*, 2007; Kuijper, 2003). With the gradual depletion of land resources, the ocean has become the destination for humans to discover new resources. As a result, various countries have begun to develop oceans and explore the ocean (Kontogianni *et al.*, 2012; Silke, 2015). What comes along with it is the growing emergence of marine environmental problems. Red tide and petroleum pollution have also begun to cause greater harm to human life (Chen, 2016; Fletcher, 2009). China boasts more than 3 million square kilometers of sea area with a vast coastline and abundant marine resources. However, the cognition and management of the ocean was not enough in the past so that the marine environment has been severely damaged and

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marine disasters have become more frequent (Wynveen *et al.*, 2014). In this context, strengthening the cognition and management of marine environmental protection has also become a major topic in China. How to enhance the cognition of marine environmental protection, how to establish the concept of sustainable development, and how to achieve a harmonious relationship between humans and the ocean has become the top priority of marine environmental protection (Glazar and Grubisic, 2012).

There are four perspectives on the marine environmental cognition, including knowledge, sensitivity, attitude and behavior of the marine environment. Based on these four aspects (Goldsmith, 2012; Helen and Hannah, 2007), the paper first designs questionnaires about these four perspectives, and distributes them, then summarizes and analyzes valid questionnaires. Finally, it proposes policy suggestions for management of marine environmental protection according to the analysis results of questionnaires.

Analysis of Marine Environmental Cognition *Questionnaire design and survey results*

The analysis of this paper focuses on the four perspectives of marine environmental cognition. According to these four perspectives, a set of targeted and reasonable questionnaires has been designed. Based on the specific data of questionnaires, this paper conducts relevant analysis to discuss the influence factors and development trends. The design of questionnaires mainly focuses on the four perspectives of marine environmental cognition and it also includes some basic information of the respondents, such as age, gender, and school. The survey is an anonymous survey on college students in Shandong Province and the results are only used for this research.

The topics related to the marine environmental knowledge are involved in national marine nature reserve, red tide, wetland policies, and marine environment policies and regulations. And the topics come from the websites of marine related departments and marine knowledge contests. This part consists of 4 single-choice questions. The survey results show that the average core is 2.3 points, and students with 2-3 points account for a relatively high proportion, indicating that most of the college students' marine environmental knowledge is at the intermediate level.

The topics of marine environmental sensitivity focuses on the crisis faced by the oceans, including the quality of sea water in the East China Sea, the status quo of China's marine litter, hygiene of the East China Sea, excessive fishing in the East China Sea, and marine pollution. It mainly investigates students' concerns and cognition of marine environmental problems, as well as the overall evaluation of marine environmental protection by relevant government departments. This part consists of 5 questions. The answer options are "not serious", "not too serious", "generally serious", "quite serious" and "very serious". 1 point, 2 points, 3 points, 4 points and 5 points are taken respectively for the calculation of the average score. The survey results show that the average score of each question is 3.5 points, and students with 3-4 points of each question account for a large proportion (about 80.7%), indicating that the marine environmental sensitivity of college students is at the above-average level.

The topics of the marine environmental attitude are to measure the students' attitude towards the relationship between marine environmental protection and economic development, the relationship between science and technology and marine environmental protection, the relationship between human development and ocean, carrying capacity of marine environment, and marine environmental protection activities. This part consists of 7 questions and each question scores points. The scores from positive to negative are 5 points, 4 points, 3 points, 2 points, and 1 point respectively. The survey results show that the average score of each question is 3.9 points, indicating that the college students have a quite positive attitude towards the marine environment.

The topics of the marine environmental behavior is to examine whether students will participate in marine environmental protection practices, whether they will stop marine pollution behaviors in a timely manner, whether they will purchase green environmental-friendly products, whether they will conduct marine environmental protection publicity, whether they will participate in the discussion of issues of the marine environment, and whether they will participate in specific activities such as marine environmental protection management. This part consists of 6 questions. The answers are "every time", "most", "occasionally", "rarely", "never", which is scored 5 points, 4 points, 3 points, 2 points and 1 point.



Table1. Correlation

		Knowledge	Sensitivity	Attitude	Behavior
Knowledge	Pearson correlation	1	0.092**	0.146**	0.008
	significance		0.000	0.000	0.706
	N	1789	1789	1789	1789
Sensitivity	Pearson correlation	0.092**	1	0.471**	0.176**
	significance	0.000		0.000	0.000
	N	1789	1789	1789	1789
Attitude	Pearson correlation	0.146**	0.471**	1	0.234**
	significance	0.000	0.000		0.000
	N	1789	1789	1789	1789
Behavior	Pearson correlation	0.008	0.176**	0.234**	1
	significance	0.706	0.000	0.000	
	N	1789	1789	1789	1789

Notes: ** represents a significant correlation at the 0.01 level.

The survey results show that the average score of each question is 2.9 points, indicating that the students' marine environment behavior is negative overall.

Analysis of survey results

(1) Correlation of four parts of marine environmental cognition

According to the foregoing discussion, the marine environmental cognition mainly consists of four parts: knowledge, sensitivity, attitude, and behavior. This part uses statistical software SPSS to analyze the correction of four parts of the marine environmental cognition discussed above. The correlation coefficients are shown in Table 1.

It can be seen from the positivity, negativity, size, and significance of the correlation coefficient of the four correction factors in Table 1 that for college students, the impact of the marine environmental knowledge from books is not significant if they want to change their marine environmental behavior. That is to say, there is no obvious promotion effect. Instead, attitude and sensitivity shall be strengthened to allow students to have more contact with the ocean and conduct in-depth researches and investigations so that they can change their sensitivity and attitude in the contact so as to improve their positivity in marine environmental protection. This is an important step and method to improve the marine environmental cognition.

(2) Status quo of marine environmental cognition

According to the findings of the four parts of the marine environmental cognition, the average score of the marine environmental cognition is 12.7 points, and the statistics are shown in Table 2. It can be seen that the highest score is 12.7 points and the lowest is 5.6 points.

In the analysis, the samples are divided into 7 groups according to the scores of the marine environmental cognition (5-7, 7-9, 9-11, 11-13, 13-15, 15-17, 17-18) and grouping statistics results are shown in Figure 1. It can be seen from Figure 1 that students with scores of 11-13 and 13-15 account for a total of 80.5%, indicating that most of the students' marine environmental cognition is in the intermediate level, and those who are particularly good or very poor are relatively few.

Table 2. Marine Environmental Cognition Statistics

N	Valid	1798
	Missing	0
Mean		12.7
Min		5.6
Max		17.5

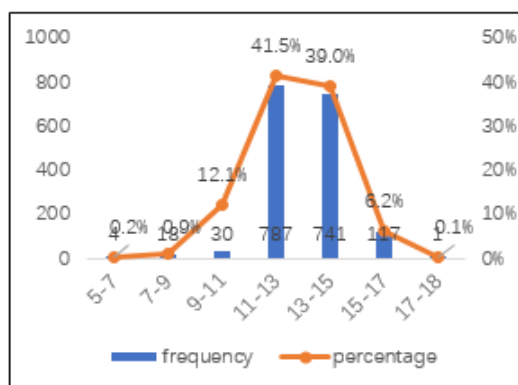


Figure 1. Grouping statistics

(3) Analysis of influence factors

This part takes the human brain's marine environmental cognition as an explanatory variable and analyzes its correlation with personal basic information, as shown in Table 3. It can be seen from Table 3 that the marine environmental cognition is significantly related to the home location, whether there are relatives



Table 3. Marine environmental cognition factors

	Marine environmental cognition		
	Pearson correlation	Significance	N
Marine environmental cognition	1		1789
Gender	-0.44	0.056	1789
Grade	-0.186	0.061	1789
Major	0.057	0.071	1789
Home location	-0.146**	0.000	1789
Does any of your relatives engage in occupations related to the marine environment?	-0.119**	0.000	1789
Do you engage in Activities at sea (surfing, swimming in the sea)?	-0.126**	0.000	1789
How often will you touch a sea?	0.029	0.221	1789
Do you care about the marine environment	-0.358**	0.000	1789

Notes: ** represents a significant correlation at the 0.01 level.

engaged in marine environment occupation, whether they are engaged in marine activities and whether they are concerned about the marine environment while there is no significant correlation with gender, grade, major, and whether they are in constant contact with the ocean.

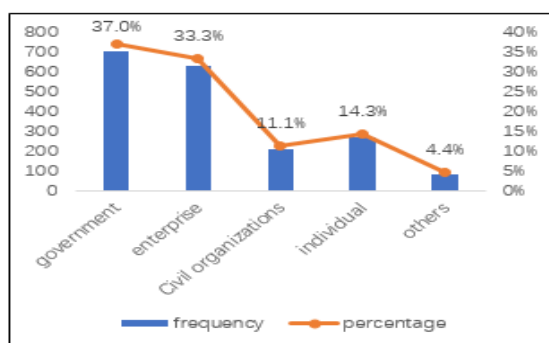


Figure 2. The main subject liability of the marine environment

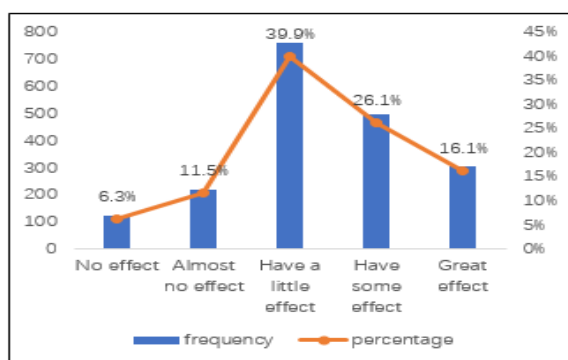


Figure 3. The role of individuals in marine environmental protection

(4) Subject to liability of marine environment

As for the subject to liability for the emergence of marine environmental problems, the survey results are shown in Figure 2 and Figure 3. It can

be seen from Figure 2 that most of the students believe that the main subject liability is the

government and the enterprise, and only a few students think that the main subject liability is individuals and non-governmental organizations.

It can be seen from Figure 3 that college students have low expectations for individuals. In their eyes, although individuals can play a certain role, individual strength is still limited because marine environmental protection is a big project.

(5) Marine environmental protection work

With regard to the impact of marine environmental protection on China's future development, the statistical results are shown in Figure 4. It can be seen from Figure 4 that most college students still think that the marine environmental protection work is of great significance and it is also very beneficial to China's future development to improve the current environment.

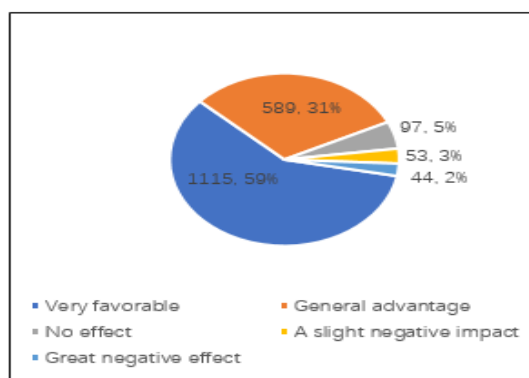


Figure 4. Impact of Marine Environmental Protection Work on China's Future

With regard to which measure is more important to improve the quality of the marine environment, the results are shown in Figure 5. It can be seen from Figure 5 that the surveyed



college students believe that the two measures of “strengthen environmental protection education” and “improve environmental protection laws and regulations” are the most important. This shows that China’s current marine environmental protection education is not enough, and China’s laws and regulations are not particularly perfect.

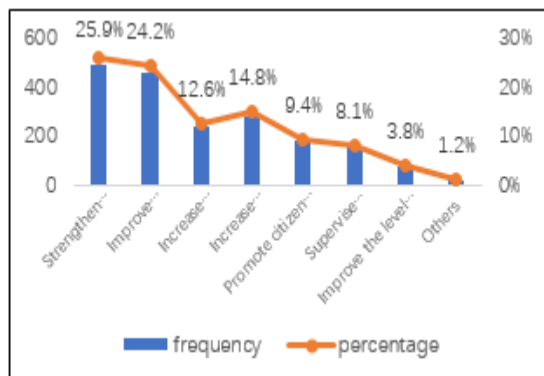


Figure 5. Which measure is more important to improve the marine environment

Marine Environmental Management Methods

Based on survey results of college students’ marine environmental cognition and the analysis of the results, this paper proposes the following policy suggestions for marine environmental management.

Led by the government

According to the results of the questionnaires, most college students believe that subject to liability of the marine environmental protection is the government, which shows that the government has high credibility. Therefore, the government should take the lead in raising the public’s cognition of marine environmental protection, which is to change the brain activity of the public to some extent so that they can pay attention to marine environmental protection. Secondly, the government should take the lead to improve the relevant laws and regulations, and establish a special agency responsible for monitoring and studying the marine environment to carry out long-term observation and research so as to find problems and improve problems in a timely manner. Finally, the government should further improve the safety facilities in the coastal areas, build a safe coastal environment, and provide the public with a safe marine environment in contact with the oceans and marine activities, which will also improve the public’s marine environmental cognition to a certain extent.

Focus on education

According to the survey results, there is a significant positive correlation between the marine environmental knowledge and the marine environmental sensitivity and attitude. From the sample survey of college students in Shandong Province, this paper finds that there are still relatively few marine-related courses and majors offered by some colleges and universities. More than 70% of students have never attended marine-related courses. At the same time, many students want to attend marine environment-related courses, as shown in Figure 6. Therefore, college and universities should pay full attention to the lack of courses and students’ lack of relevant knowledge, and open relevant courses according to their own situation, as well as encourage students to actively participate in these courses so as to enrich their knowledge.

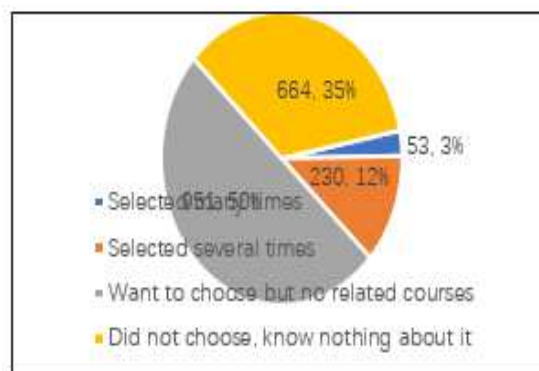


Figure 6. Selection of Marine Environment-related Elective Courses

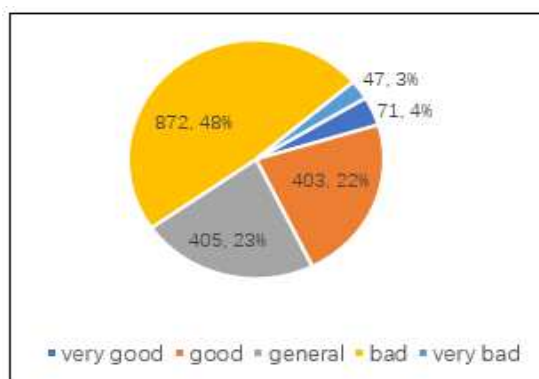


Figure 7. Government’s publicity work on marine environmental protection

Improve publicity

In the survey, as for the topic “government’s publicity work on marine environmental protection”, students’ selection is shown in Figure 7, showing that the government’s publicity on



marine environmental protection is not enough. Therefore, the government should appropriately promote the development of the marine economy in the background of the new era, pay attention to the rational development and utilization of the ocean, focus on its sustainable development, and further publicize relevant knowledge of marine environmental protection.

Conclusions

Aiming at the cognition and management of China's marine environment, this paper designs questionnaires from the perspective of cognitive neuroscience and distributes them to 7 universities in Shandong Province. The following conclusions have been drawn by summarizing and analyzing the collected valid questionnaires.

First, the overall average score of marine environmental cognition of college students in Shandong Province is 12.7 points, which is at an intermediate level. And the average score of knowledge and behavior of the marine environment is at an intermediate level, and the average score of the sensitivity and attitude of the marine environment is at an above-average level. Second, there is a significant correlation between the marine environmental cognition and home location, whether there are relatives engaged in marine environment occupation, whether they are concerned about the marine environment and whether they are engaged in marine activities. There is a two-way positive correlation between marine environmental knowledge and sensitivity and attitude.

Third, most college students in Shandong Province believe that marine environmental protection has great significance and influence on China's future development, and support the corresponding protection work. They also believe that the government is the subject to liability for solving problems related to the marine environment, which also reflects the college students' dependence on the government and lack of self-confidence.

Fourth, to change college students' cognition of marine environmental protection (brain activity), this paper believes that the government should take the lead and further strengthen the education on college students and the public at the ideological level so as to change their ideas, as well as strengthen legislation and publicity. The role of individuals should be given full play to enhance the marine environmental cognition in daily life.

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