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Characteristics of Disaster Education in Chinese Senior High School Geography Textbooks

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Abstract: Disaster education is one import way to mitigate disaster and protect lives, and the geography textbooks are key to achieving these goals. Chinese senior high school risk geography textbooks contain various disaster education content, such as meteorological disasters, marine disasters, geological disasters, biological disasters, etc. The content is logically arranged to convey systematic and universal disaster knowledge, to enhance the consciousness and action of disaster prevention and mitigation, and to form a harmonious disaster view of human and nature. Besides, the Chinese disaster education integrates the information technology to construct the disaster knowledge framework and to develop the key competence of students.

Key words: Chinese senior high school geography textbooks, disaster education, disaster risk reduction

1. Introduction

Disaster is one main constraint to sustainable development of economy, society and environment, and disaster prevention and mitigation is a major issue in achieving sustainable development. The Sendai Framework for Disaster Risk Reduction 2015–2030 points out that "disaster risk reduction is essential to achieve sustainable development" (UNISDR, 2015), which was adopted at the Third United Nations World Conference on Disaster Risk Reduction. As stated in the UN International Program of Action for the International Decade for Natural Disaster Reduction, "Education is at the center of disaster reduction programme, and knowledge is the key to success or failure in disaster reduction". Therefore, disaster education plays an important role in achieving sustainable development goals and developing citizens' disaster awareness and disaster prevention and mitigation competences (Rajib Shaw et al., 2014).

In China, one of the countries with the most serious natural disasters in the world, there are many types of natural disasters with a high incidence rate and serious damage (Sha Chen et al., 2013). According to China's Ministry of Emergency Management (MEM), in 2019, the direct economic losses caused by various natural disasters in China were 327 billion Yuan (MEM, 2020). Thus, public disaster education is important to enhance disaster awareness and disaster prevention capability of Chinese citizens. Disaster education in Chinese schools mainly includes life understanding education, general disaster awareness education, disaster prevention skills education, disaster prevention psychology education, and disaster ethics education. School disaster education aims to help students understand the laws of natural disaster occurrence and distribution, to deepen their understanding

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of the mechanism of disaster occurrence and disaster prevention, to cultivate their competence to cope with natural disaster, to establish a scientific view of disaster, to realize the importance of life, and to improve their ability to survive.

Chinese geography curriculum in basic education contains rich disaster education content. The Chinese geography textbooks intends to construct the geography knowledge structure and to develop the intelligence and competence, where the disaster education contents are the core elements to achieve the disaster education goals. The current Chinese senior high school geography textbooks were launched in the autumn semester of 2019 in various provinces across China, with five editions published by People's Education Press, Shandong Education Press, China Cartographic Publishing House, Hunan Education Press, and China Cartographic Publishing House combined Chinese Map Publishing House (Shanghai Edition). This paper selects the new composite textbooks published by China Cartographic Publishing House combined Chinese Map Publishing House (Shanghai edition) to explore the logical structure and educational significance of disaster education in Chinese senior high school geography textbooks.

2. Themes and Objectives of Disaster Education in Textbooks

Textbooks are highly significant to carry course content, construct knowledge structure, and develop intelligence and competence for students. The disaster education content in the geography textbooks is the key to implementing the goal of disaster education.

According to the requirements of disaster education in the General High School Geography Curriculum Standard (2017 edition), and the cognitive and psychological development characteristics of students, the disaster education is mainly arranged in the compulsory Geography 1 and optional 3 Natural Disasters and Prevention textbooks in Chinese senior high schools. As shown in the Table 1, this textbook contains meteorological disasters, marine disasters, geological disasters, biological disasters, etc. This paper mainly focuses on disaster education in compulsory Geography 1 textbook because all the students should learn its content to pass the examination. The optional courses are optional selected according to regional policy and specific school situation, and as a result, not all the students attach its contents. Thus, a detailed introduction to the optional 3 Natural Disasters and Prevention is not given.

Table 1 Themes and Objectives of Disaster Education in Compulsory Geography 1 Textbook in Chinese Senior High School

Topics	Types of Disasters	Objectives of Disaster Education
Meteorological Disasters	Typhoon	(1) The vision of human-earth harmony: understand the hazards of nature disaster to human survival and development; understand the man-made causes of disaster objectively; view the relationship between the natural environment and human activities dialectically, and establish a scientific view of disaster. (2) Comprehensive thinking: analyze the causes of a nature disaster; propose measures for disaster prevention and mitigation. (3) Recognition of regions: use geographical information technology to analyze and summarize the characteristics of the spatial and temporal distribution of common nature disasters in China and the world. (4) The development of practical skills in geography: use geographical tools to obtain and process information on nature disaster; investigate and probe the impact of nature disaster on human production and life; use geographical information technology to observe geographical phenomena and predict nature disaster.
	Flood	
Marine Disasters	Storm Surge	
	Algal bloom	
Geological Disasters	Earthquake	
	Landslide and Mudslide	

Source: Compulsory Geography 1 textbook in Chinese senior high school; General High School Geography Curriculum Standard (2017 edition).

Disaster education in this textbook conveys systematic and universal disaster knowledge by elaborating the causes, characteristics, hazards, and spatial and temporal distribution characteristics of disasters, which could deepen the disaster cognition of students. By providing actual disaster cases and inquiry activities, the capability to obtain disaster information and the competence to argue disaster problems could be enhanced. Besides, both individual disaster awareness and the consciousness and action of disaster prevention are stimulated (Hongliang Yang, 2016). To provide a real regional environment for students to observe, investigate and predict disaster problems, various information technologies are utilized, including Virtual Reality Technology, Remote Sensing, Geographic Information System.

Disaster education intends to stimulate the disaster awareness of students, and to promote students to master the basic theories of disaster occurrence mechanism, distribution law and hazards. The ultimate education goal is to aid students to master the disaster prevention skills, so they can scientifically and effectively rescue themselves in the face of disasters. Thus, in the textbooks, more attentions are paid to cultivate the courage of student to face the danger, to strengthen the disaster prevention and mitigation capabilities, to correctly understand the importance of human-land relationship, and to generate disaster culture.

Overall, the disaster education content in this textbook aims to prepare students to be informed and capablel individuals who can understand, prevent and mitigate disasters, and contribute to a safer and more resilient society.

3. Characteristics of Disaster Education in Textbooks

3.1 Construction of Disaster Knowledge Framework

The disaster knowledge is the basis for establishing disaster concept and disaster thinking, and it is the necessary condition for students to master disaster prevention skills. The process of knowledge generation promotes deeper development of cognition and thinking by systematic knowledge construction. In the textbook, disaster education is organized around the following themes: “concept of disaster – causes of disaster – characteristics of spatial and temporal distribution of disaster – impact of disaster – measures for disaster prevention and mitigation”, which is in line with the basic logic of disaster science and students’ cognitive development characteristics. The disaster knowledge is presented by multiple ways including text system, image system, activity system and reading aid system, and it helps students internalize knowledge and construct a cognitive framework.

This paper takes the subject of “Common Meteorological Disaster” in the chapter “Atmospheric Environment” as an example. The first two subjects are “Composition and Vertical Stratification of the Atmosphere” and “Thermal Processes and Movement of the Atmosphere”, which systematically explain the geographic concepts, processes, and principles of the composition of the atmosphere, vertical stratification of the atmosphere, thermal processes, thermal circulation and wind, etc. Then, the basic knowledge of meteorological disaster such as typhoon and flood is introduced. The concept of typhoon is explained through the text system and the figure system “Figure 2–29 Typhoon Structure Diagram”, as shown in the Figure 1, which could help students better understand the concept and structure of typhoon. Besides, the textbook also analyzes and summarizes the spatial and temporal characteristics of typhoon distribution in China through the text system and the image system “Figure 2–30 Number of Typhoons with Serious Impact on the Southeast Coast of China (1949–2000)”, as shown in the Figure 2. The text system and the activity system “Reading-thinking” are adopted to explain the impact of

typhoon, where the activity system "Reading-thinking" presents textual materials and remote sensing images of Typhoon Haiyan before and after its landfall in China, the Philippines and Vietnam in 2013, as shown in the Figure 3. To guide the students to critically consider the impact of typhoon, the inspiration questions are employed, and the measures to prevent typhoon disaster is introduced in the text and activity system.

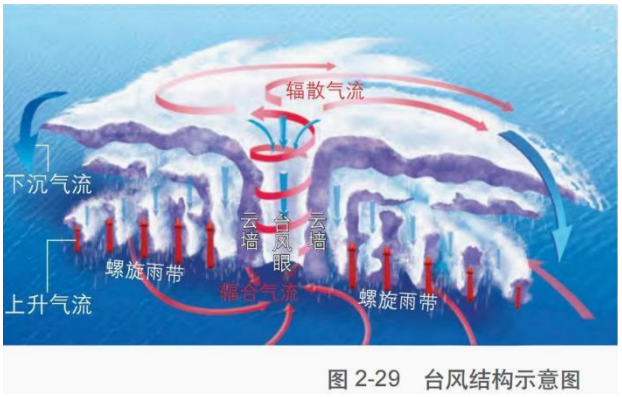

Figure 1　"Typhoon Structure Diagram" in Textbook

Figure 2　"Number of Typhoons With Serious Impact on the Southeast Coast of China (1949–2000)" in Textbook

Figure 3 The Activity System “Reading-Thinking” in Textbook

In conclusion, the text system, images system, activities system and information technology are adopted to systematically expound the concept of typhoon, the characteristics of typhoon temporal and spatial distribution, impact and prevention measures of typhoon, which forms a reasonable structured textbook surface system and a scientific and effective textbook deep system that corresponds to the cognitive development of student. As shown in the Figure 4, the textbook is helpful for students to systematically master and understand the knowledge of typhoon disasters.

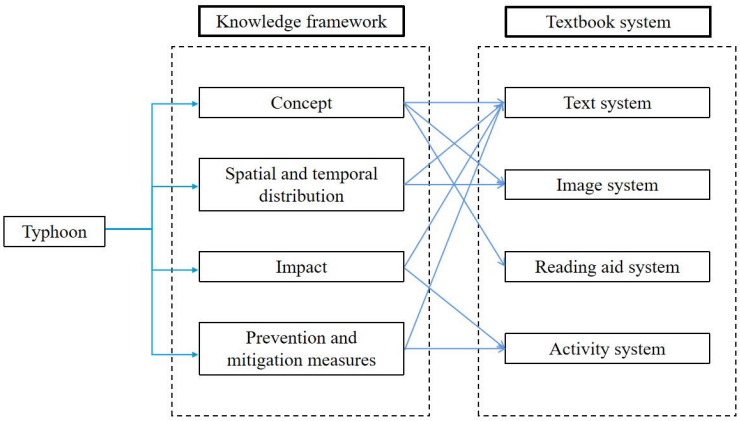

Figure 4 The Knowledge Framework and Textbook System of Typhoon in Textbook

3.2 Development of Student Competence

For each disaster education topic in the textbook, one activity system is designed based on the reading-thinking, inquiry, activity, and thematic exercise sections. This activity system is intended to develop the practical skills and competence of student in face of disaster, which aids students to internalize the knowledge structure of disaster and to externalize the behavior of analyzing and solving specific natural disaster situation. Besides, the tasks, focusing on link theory to practice and solving real-life problems, are designed for students to cultivate their core competence.

The tasks in the activity system are formed in a progressive chain of questions, which integrates the basic

methods and ideas of geographic research and exhibits the core geographic competence such as comprehensive thinking and region recognition. For example, the activity "Access to earthquake information through online disaster database" provides a search tool of "China Earthquake Network" to identify the earthquakes happened in the worldwide for last 7 days, the magnitude 7 earthquakes happened in the worldwide since 1960, and the earthquakes happened near students' hometown for last ten years. Then, students are asked to map out the spatial distribution of earthquakes around the world and analyze the causes of earthquakes based on the information they have found. This activity requires students to explore the characteristics of earthquakes at different spatial and temporal scales, to consider the spatial and temporal connections of disasters, and to develop their capabilities of regions recognition and comprehensive thinking.

Disaster education focuses on the combination of theory and practice, and it also pays attention to solve practical problems in real lives. The knowledge not only should be taught for students, but also should be externalized in their practical lives to enhance prevention and preparedness actions (Rajib Shaw et al., 2021). If the disaster knowledge is polished by geographic practice, it could break through the limits of individual mental cognition and integrate into real life of student to solve real-life problems and strengthen the nurturing value of disaster education. For example, "Investigation of Campus Drainage", an activity in the subject of common meteorological disaster, aims at "understanding the drainage condition of the campus, investigating the waterlogged areas of the campus after heavy rain, and putting forward rationalized suggestions for improving the drainage of the campus that may exist". Students carry out the progressive practical activities of "problem formulation – field investigation – data collection – analysis and demonstration – problem solving". The competence to solve practical problems could be cultivated by the process of guiding students to analyze the current flooding events in their lives, where they can recognize, grasp and understand the dialectical and harmonious relationship between human beings and the natural environment.

3.3 Application of Information Technology

The information technology is applied to present disaster situations, and to provide a realistic regional environment for students to observe, explore, and predict disaster problems. As shown in the Table 2, with the rapid development of geographic science and information technology, such as Geographic Information System, Virtual Reality Technology, Remote Sensing, and online disaster databases, the advanced geographic tools could be utilized to guide students to recognize and understand the application of information technology in disaster prediction and forecasting, data analysis, and disaster relief. According to the Table 2, the information technology is applied into each disaster education about 2 to 4 times on average, where the remote sensing technology has the highest application frequency. By applying information technology, information competence could be enhanced and scientific spirits of persistently exploring problems and actively seeking effective solutions are also cultivated. Besides, the students could be guided to recognize and understand the application of information technology in disaster prediction and forecasting, data analysis and earthquake relief.

Table 2 The Statistics of Information Technology in Disaster Education

Contents of the disasters		Type and number of applying information technology				in Compulsory Geography 1 Textbook
		Geographic information system	Remote sensing technology	Virtual reality technology	Online disaster database	
Meteorological	Typhoon	1	1	0	1	3

Disasters	Flood	1	2	0	0	3
Marine Disasters	Storm Surge	1	1	0	0	2
	Algal Bloom	1	2	0	0	3
Geological Disasters	Earthquake	1	1	1	1	4
	Landslide and Mudslide	0	2	0	0	2
Total		5	9	1	2	17

For example, in the geological disaster activity named "Using virtual reality technology to feel the impact of geological disaster", the teachers and students utilize VR equipment to watch the simulation video of earthquake disaster and to feel the scenes of geological disaster, which could stimulate the thinking of the life value, understand the scientific concept of disaster, and learn how to handle geological disasters. This activity could aid student further to understand the technical conditions provided by virtual reality technology for learning and studying disasters, master the knowledge to avoid and reduce the hazards caused by geological disasters, and enhance their consciousness and action of disaster prevention.

4. Conclusion

In the process of sustainable development, education is one important way to mitigate disaster risk and protect lives (Eryong Xue, 2008). Education that teaches the basic knowledge and skills of disaster mitigation and prevention plays an extremely active role in disaster mitigation and risk control. The geography curricula in basic education contain rich resources for disaster education, and the content and characteristics of disaster education organized in geography textbooks are the core elements for achieving the education goals.

The topics of disaster education in Chinese senior high school geography textbooks include meteorological disaster, marine disaster, geological disaster, biological disaster, etc. The content of typhoon, flood, storm surge, algal bloom, earthquake, landslide and mudslide is selected according to Chinese disaster situation and the regional curriculum standards. This spread systematic and universal disaster knowledge, develop students' competence to obtain disaster information and argue disaster problems, and enhance the consciousness to prevent disaster harm.

There are three main features of disaster education in Chinese senior high school geography textbooks: (1) construction of the disaster knowledge framework; (2) development of competence of student; (3) application of information technology. Disaster education is logically organized, and it contains the cutting-edge science and technology as well as student-centered experiential activities. Through the disaster education, the disaster cognitive system of students could be gradually enriched by "know what – know why – how to do", the disaster prevention and mitigation ability of students are enhanced, and a sustainable development concept of dialectical coordination between human and environment could be established.

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