The Development of Environmental Education Curriculum Based on Community Participation to Promote Senior High School Students' Environmental Conservative Mind

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Abstracts

The environmental education curriculum based on community participation makes full use of the excellent teaching resources in the community to serve environmental teaching; lets students go out of school to receive environmental education in nature; and takes rich comprehensive practical activities as the teaching carrier, so that students can experience and realize knowledge in the activities. Compared with the mode of infiltration education in school, the mode of environmental education based on community participation is more popular among students and achieves better educational results.

The objectives of this research were: 1) to investigate the current situation and effectiveness of high school environmental education curriculum and high school students' environmental conservative mind, 2) to develop an environmental education curriculum based on community participation, and 3) to implement the environmental education curriculum based on community participation and to compare the differences in environmental conservative mind of high school students before and after the implementation of the environmental education curriculum based on community participation.

This study used quantitative methods to explore the differences in environmental conservative minds of high school students before and after the implementation of the environmental education curriculum based on community participation. Based on the two characteristics of "community participation" and "localization of content", the researchers developed an environmental education curriculum through questionnaire surveys and educational experiments. A total of 234 high school students were selected to investigate the current situation and effectiveness of the environmental education curriculum in senior high schools and environmental conservative mind of students in the first grade of Zhanjiang No. 20 Middle School, and 30 high school students participated in the newly developed environmental education curriculum. After the implementation of the environmental education curriculum, the environmental conservative mind of high school students increased significantly.

* Received: November 6 2023; Revised: November 14 2023; Accepted: November 15 2023

Keywords: Environmental education curriculum; Environmental conservative mind; Development of curriculum; Community participation

Introduction

With the deterioration of the environment around the world, people are increasingly aware of the necessity and urgency of environmental conservation for human survival and development. Countries around the world have also taken actions to prevent the further deterioration of environmental problems and the emergence of new problems. Nowadays, environmental education is one of the effective ways to solve various environmental problems(Zhu, 1994).

In 2003, the Ministry of Education of China promulgated the "educational syllabus of environmental education topics for primary and secondary school students", which proposed to carry out special education courses on environmental education in primary and secondary schools, requiring the combination of special courses on environmental education and educational and teaching activities, and to implement environmental education in primary and secondary schools（Ministry of Education,2003）.

Environmental education should not be limited to classroom teaching, but should stimulate students' interest in learning and guide students to actively participate in environmental conservation public welfare activities in the community. A variety of extracurricular activities and social practice are conducive to the application of environmental knowledge learned in classroom teaching to real life(Xiao, 2009).

At present,， school environmental education is mainly in the form of various activities sponsored by the education department and permeable environmental education of various disciplines. Good results, but a "localized" environmental education system and model that not only conforms to the development trend of international environmental education, but also conforms to China's national conditions and reflects Chinese characteristics has not yet been formed(Li , 2004).

The mangrove reserve in Zhanjiang, Guangdong is the largest mangrove reserve in the country, and the mangrove is a business card of Zhanjiang. Mangrove is a typical wetland ecosystem, and it is a hot topic of research by ecological experts and environmental conservation experts. Many topics such as the reduction of mangrove forest area in the country, the reduction of species diversity, the impact of solid floating garbage, and the invasion of alien species Spartina alterniflora are suitable for development Environmental education(Chen & Hu, 2011).

Based on the above factors, in order to solve the problem of the lack of teaching materials with local characteristics in the environmental education of high schools in Zhanjiang City, the teaching and learning activities of environmental education classrooms are carried out through the carrier of mangroves, and the comprehensive practical activities of high schools based on Zhanjiang mangroves are carried out, which are constantly adjusted and improved. Revise and develop curriculum that meets the environmental education needs of high school students in Zhanjiang City, to improve students' environmental conservative mind.

In conclusion, at this stage, environmental education has been emphasized by all high schools, and research on various teaching modes and curriculum design is underway, in a state of blossoming. In this context, we combined the factors of "community-based participation",

"localization", "outdoor integrated practice activities", and "environmental conservative mind questionnaire" to conduct the study and achieved good results.

Methodology

There were 3 steps of research process:

step 1 The studying about the current situation and effectiveness of the environmental education curriculum in senior high schools and environmental conservative mind of students in the first grade of Zhanjiang No. 20 Middle School .

step 2 The development of environmental education curriculum based on community participation to promote senior high school students' environmental conservative mind .

step 3 The experimental and improvement of environmental education curriculum. By accessing the efficiency of environmental education curriculum and comparing to senior high school students' environmental conservative mind before and after the implementation of curriculum.

Population and sample

637 students in the first grade of Zhanjiang No. 20 Middle School. 234students were selected as experimental subjects, the survey in the semester 1 academic year 2023. 30 senior students were selected to implement the curriculum during the first semester of the academic year 2023.

Research Instruments

1. Questionnaire on the current situation and effectiveness of high school environmental education curriculum and high school students' environmental conservative mind. Which was divided into two parts. The first part is personal background information, including gender, age, type of household registration, way of going to school , and opportunities to use computers or mobile phones to read web pages, used to understand the basic situation of the research subjects.

The second part is the Environmental conservative mind research scale. As shown in the table 1 measure tool dimensions, the level of Environmental conservative mind is measured through 3 dimensions : cognitive/knowledge about environment conservative; attitude/affective about environment conservative; and behavior/psychomotor about environment conservative. Each dimension is measured by 7 questions, with a total of 21 questions. The answer is evaluated using the Likert 5-point scale. Among them, 1 is "completely unaware", "completely disagree", or "no"; 5 is "fully understood", "fully agreed", or "very much". From 1 to 5, it represents a increase in understanding or agreement, or a increase in such behavior.

The way to calculate the score is to choose the answer of 1-5, which is equivalent to getting 1-5 points; the 9th, 16th and 17th questions are the opposite calculation of the score, and the answer of 1-5 is equivalent to getting 5-1 points. The higher the total score, the higher the environmental conservative mind.

2. Developed a teaching program and Lesson Plan for the development of environmental education curriculum based on community participation to promote senior high school students' environmental conservative mind.

The teaching program contains the Curriculum Objectives、Content structure and timing、Media and learning resources. The whole program is divided into five thematic

activity units, each unit contains Lesson 1: Theoretical Learning（Location: Multimedia Classroom）、Lesson 2: Carry out practical activities（Location: Mangrove Forest Reserve）、Lesson 3: Promotion of practical activity achievements（Location: School and community）.

3.Questionnaire on the level of environmental conservative mind.

The questionnaire is divided into two parts. The first part is personal background information, including gender, age, type of household registration, way of going to school , and opportunities to use computers or mobile phones to read web pages, used to understand the basic situation of the research subjects.

The second part is the Environmental conservative mind research scale. The level of environmental conservative mind is measured through 3 dimensions: cognitive/knowledge about environment conservative; attitude/affective about environment conservative; and behavior/psychomotor about environment conservative. Each dimension is measured by 14 questions, with a total of 42 questions. The answer is evaluated using the Likert 5-point scale. Among them,1 = the least agree with; 2 = less agree with; 3 = Agree with;4 = much agree with; 5 = the most agree with .

The way to calculate the score is to choose the answer of 1-5, which is equivalent to getting 1-5 points; the 7th, 12th and 13th questions are the opposite calculation of the score, and the answer of 1-5 is equivalent to getting 5-1 points. The higher the total score, the higher the environmental conservative mind.

Data Collection

A total of 234 high school students were randomly selected as the survey sample to distribute the environmental conservative mind questionnaire and complete data collection.

Before the teaching experiment, 30 students in the first grade of Zhanjiang No. 20 Middle School were tested with the environmental conservative mind questionnaire of high school students.

After the teaching experiment, 30 students in the Zhanjiang No. 20 Middle School used the environmental conservative mind questionnaire of high school students to conduct a test.

Data analysis

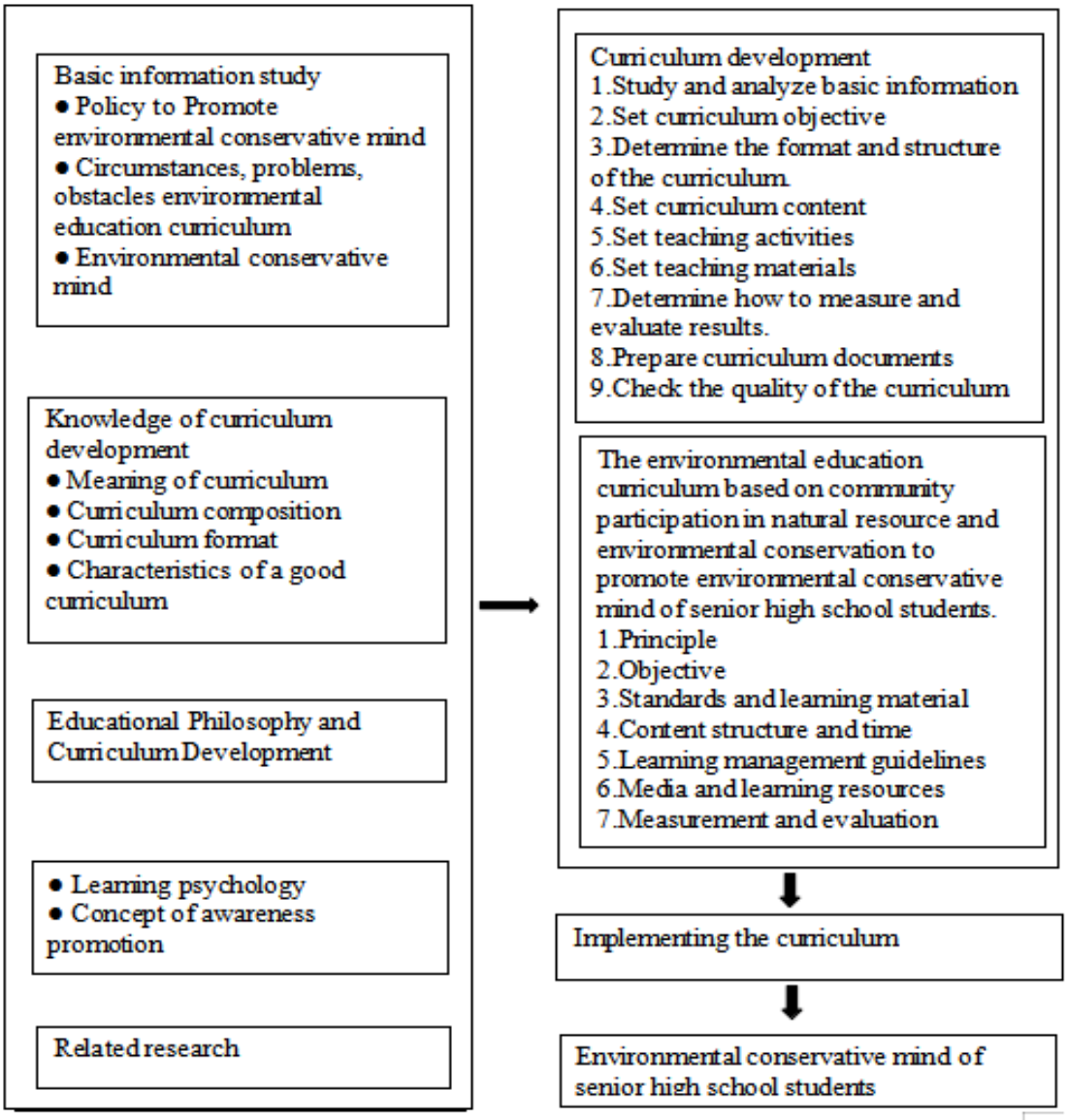
Part 1: An evaluation was conducted on the survey questionnaire on the current situation and effectiveness of environmental education courses in high schools of Zhanjiang No. 20 Middle School, the environmental education curriculum based on community participation, and the students' environmental conservative mind survey questionnaire used for pre and post curriculum implementation. The evaluation results of the three experts were in line with the requirement.

Part 2: To investigate the current situation and effectiveness of high school environmental education curriculum and high school students' environmental conservative mind, distribute survey questionnaires to students and rate them based on their specific answers.

Part 3: The experimental and improvement of environmental education curriculum. By accessing the efficiency of environmental education curriculum and comparing to senior high school students' environmental conservative mind before and after the implementation of curriculum.1) Conducting surveys on environmental conservative mind among survey respondents, find the mean ($\bar{X}$) and standard deviation (S.D.). 2) Compare the differences of mean scores and (S.D.).The learning adaptability both pre-experimental and post-experimental.by testing the statistical using statistics (t - test for dependent)

Regarding 'ranking', it is divided into 5 levels based on scores, getting 0-1 is level 1, interpret is very poor; 1-2 is level 2, interpret is poor;2-3 is level 3, interpret is common;3-4 is level 4, interpret is good;4-5 is level 5, interpret is very good.

Research Framework



Research Result

Step 1 The studying about the current situation and effectiveness of the environmental education curriculum in senior high schools and environmental conservative mind of students in the first grade of Zhanjiang No. 20 Middle School .

Table 1 mean and standard of data analysis on cognitive/knowledge about environment conservative

cognitive/ knowledge about environment conservative	**$\bar{x}$**	**SD.**	**Interpret**	**Ranking**
1.Students have knowledge about environmental protection.	3.36	0.88	Good	4
2. Students have knowledge about the generation of marine waste and its impact on the environment.	3.28	0.97	Good	4
3.Students show the awareness of the importance of mangrove ecosystem biodiversity and the necessity of its protection.	3.32	1.01	Good	4
4. Students have knowledge about the mangroves fix carbon dioxide and release oxygen to reduce greenhouse efficiency.	3.44	1.02	Good	4
5. Students have knowledge about the threat of Introduced species invasion to local ecosystems and species	3.75	0.97	Good	4
6.Students have knowledge about environmental protection laws and regulations.	2.83	1.04	Common	3
7. Students have Sources of environmental protection knowledge.	3.64	1.01	Good	4
Total	**3.38**	**0.99**	**Good**	**4**

From Table 1, the general performance of environmental conservative mind in cognitive/knowledge about environment conservative is Good ($\bar{x}$= 3.38). Considering each item separately, it is found that “Students have knowledge about the threat of Introduced species invasion to local ecosystems and species” is the highest rank which is in the Good level($\bar{x}$=3.75),followed by ”Students have Sources of environmental protection knowledge.(Including TV, internet, newspapers, books, experts, elders, school curriculum, social environmental protection campaigns, etc.) ”($\bar{x}$=3.64),while “Students have knowledge about environmental protection laws and regulations (The laws and regulations include the Wildlife Protection Law, Marine Environmental Protection Law of the China, Environmental Protection Law of the China and Measures for the Administration of Alien Invasive species)” is the lowest($\bar{x}$=2.83).

Table 2 mean and standard of data analysis on attitude/affective about environment conservative

attitude/affective about environment conservative	**$\bar{x}$**	**SD.**	**Interpret**	**Ranking**
1. Students think of The important of environmental protection to society	4.58	0.80	Very Good	5
2. Students' view that "China has vast territory and abundant natural resources, and there is no resource crisis"	3.47	1.17	Good	4
3.Students' view that "It's unethical to casually dispose of garbage."	4.37	1.08	Very Good	5
4.Students' view that "personal environmental behavior can have a positive impact on protecting the environment'."	4.24	1.09	Very Good	5
5.Students' willingness to contribute to the environmental industry	4.06	1.02	Very Good	5
6.Students' willingness to participate in environmental volunteer service activities	3.68	1.21	Good	4
7.Students' views that "the environment in their area has improved in recent years".	3.39	1.05	Good	4
Total	**3.97**	**1.06**	**Good**	**4**

From Table 2, the general performance of environmental conservative mind in attitude/affective about environment conservative is Good ($\bar{x}$=3.97). Considering each item separately, it is found that " Students think of The important of environmental protection to society" is the highest rank which is in the Good level($\bar{x}$=4.58),followed by "Students' view that 'It's unethical to casually dispose of garbage." ($\bar{x}$= 4.37), while "Students' views that 'the environment in their area has improved in recent years.'" is the lowest($\bar{x}$=3.39).

Table 3 mean and standard of data analysis on behavior/ psychomotor about environment conservative

Behavior / psychomotor about environment conservative	**$\bar{x}$**	**SD.**	**Interpret**	**Ranking**
1.Behaviors in students' daily lives that are conducive to environmental protection (e.g., saving water, saving electricity, recycling plastic bags, separating garbage for recycling, etc.)	3.72	1.02	Good	4

2.The behavior of students trampling on the lawn to take shortcuts	3.17	1.15	Good	4
3.The behavior of students consuming wild animals and using related products in their daily lives	3.59	0.97	Good	4
4.The behavior of students choosing to walk or ride bicycles in daily travel	3.74	1.21	Good	4
5.Students persuade or prevent people around them from damaging the environment (such as littering).	3.38	1.27	Good	4
6.Students participate in environmental protection and ecological civilization themed activities (such as afforestation or environmental protection volunteer activities).	3.12	1.22	Good	4
7.Students have previously promoted knowledge about environmental protection to people around them	3.08	1.27	Good	4
Total	**3.40**	**1.16**	**Good**	**4**

From Table 3, the general performance of environmental conservative mind in behavior / psychomotor about environment conservative is Good ($\bar{X}$= 3.40). Considering each item separately, it is found that “ The behavior of students choosing to walk or ride bicycles in daily travel.” is the highest rank which is in the Good level($\bar{x}$=3.74),followed by” "Behaviors in students' daily lives that are conducive to environmental protection (e.g., saving water, saving electricity, recycling plastic bags, separating garbage for recycling, etc.)” ($\bar{X}$= 3.72),while “Students have previously promoted knowledge about environmental protection to people around them.” is the lowest($\bar{x}$=3.08).

Table 4 mean and standard of data analysis on senior high school students' environmental conservative mind from different tendencies overall.

Gender	$\bar{x}$	**SD.**	**Interpret**
1.Man.	3.47	0.62	Good
2.Female	3.69	0.49	Good
Total	3.59	0.56	Good
Age	$\bar{x}$	**SD.**	**Interpret**
1.14 years old	3.17	0.57	Good
2.15 years old	3.60	0.56	Good
3.16 years old	3.60	0.54	Good
Total	3.59	0.56	Good

Type of household registration	$\bar{x}$	SD.	Interpret
1. City	3.63	0.57	Good
2. Rural	3.55	0.53	Good
Total	3.59	0.56	Good

Way of going to school	$\bar{x}$	SD.	Interpret
1. Day student	3.54	0.59	Good
2. Resident student	3.65	0.50	Good
Total	3.59	0.56	Good
Opportunities to use computers or mobile phones to read web pages	$\bar{x}$	**SD.**	**Interpret**
1.No	3.23	0.70	Good
2.very few	3.64	0.56	Good
3.medium	3.57	0.53	Good
4.a little more	3.62	0.51	Good
5.Many	3.65	0.63	Good
Total	3.59	0.56	Good

From the table 4, we can see that, in the whole sample, the average score reached the Good level ($\bar{X}$ =3.59). From the gender perspective, girls have better environmental conservative mind than boys, and girls got a score of Good ($\bar{X}$=3.69). From the type of household registration perspective, City students have better environmental conservative mind than rural students, and city students got a score of Good ($\bar{X}$=3.63). From the way of going to school perspective, resident students have better environmental conservative mind than day students ($\bar{X}$=3.66). From the age perspective, students who are 15,16 years old have better environmental conservative mind and got a score of Good($\bar{X}$=3.60). From the opportunities to use computers or mobile phones to read web page perspective, students who have many opportunities to use computers or mobile phones to read web pages have good environmental conservative mind and got a score of Good($\bar{X}$=3.65).

Step 2 The development of environmental education curriculum based on community participation to promote senior high school students' environmental conservative mind .

The goal of an environmental education curriculum based on community participation is to promote senior high school students' environmental conservative mind. This study sorted out the concepts and theories of senior high school environmental education curriculum, environmental conservative mind, and curriculum development, and identified the teaching objectives, teaching process, and learning resources of a community participation-based environmental education curriculum. The course also successfully passed the Index of

Objective Coherence (IOC) test by three experts in related fields. The course consists of five units totaling 25 hours (credit hours), covering topics such as Carry out mangrove biodiversity survey, identify and clean up the alien invasive organism "Spartina alterniflora ", and learn the Management Measures for Alien Invasive species ; Carry out bird watching activities in mangroves, understand bird diversity, and learn about the Wildlife Protection Law ; Carry out mangrove drifting garbage salvage activities, analyze the causes of marine drifting garbage and its harm to mangroves, and study the Environmental Protection Law of the China. ; Carry out mangrove drifting garbage salvage activities, analyze the causes of marine drifting garbage and its harm to mangroves, and study the Environmental Protection Law of the China ; Carry out the creation of mangrove literature and art - the story between me and the mangrove forest, expressing the mangrove forest through prose, stories, poetry, painting, photography, and other means.

Step 3 The experimental and improvement of environmental education curriculum. By assessing the efficiency of environmental education curriculum and comparing it to senior high school students' environmental conservative mind before and after the implementation of curriculum.

Table 5 Comparison of pre-and post-test results of students' environmental conservative mind

Environmental conservative mind	Pre-test		Post-test	
	$\overline{X}$	S.D.	$\overline{X}$	S.D.
1.cognitive/knowledge about environment conservative	3.84	0.57	4.10	0.94
2.attitude/affective about environment conservative	3.92	0.50	4.27	0.69
3.behavior/psychomotor about environment conservative.	3.64	0.69	4.25	0.69
Total	**3.80**	**0.55**	**4.21**	**0.77**

From Table 5，it can be seen that senior high school students' environmental conservative mind has made great progress total of mean from 3.80 in the pre-test, to 4.21 in the post-test. From each specific dimension, the average score of post-test has all made obvious progress compared with the pre-test, among which .behavior/psychomotor about environment conservative about environment conservative has made the greatest progress, while cognitive/knowledge about environment conservative is the smallest. Judging from the pre-test data, it is found that attitude/affective about environment conservative is the highest($\overline{x}$=3.92);followed by cognitive/knowledge about environment conservative ($\overline{x}$=3.84); while behavior/psychomotor about environment conservative is the lowest($\overline{X}$=3.64).From the post-test data, it is found that attitude/affective about environment conservative is the highest($\overline{X}$ =4.27);followed by behavior/psychomotor about environment conservative($\overline{X}$ =4.25);while cognitive/knowledge about environment conservative is the lowest($\overline{\overline{X}}$=4.10).

Table 6 t-test for pre-test and post-test scores of students' environmental conservative mind

environmental conservative mind	$\bar{x}$	S.D.	df	t	Sig.
1. Pre-test	159.53	20.32	29	-3.279**	0.003
2. Post-test	176.60	25.99			

** represents statistic significant differences at .01

From Table 6 the data shows that through paired sample T test, it is found that there are statistic significant differences at .01 level in between the pre-test and post-test scores of students' environmental conservative mind (t=-3.279, p=0.003<0.01), in which the mean of the pre-test scores is 159.53 and the mean of the post-test scores is 176.60.

Discussion

This study will discuss the conclusions according to the order of research purposes.

1. Discussion on the studying about the current situation and effectiveness of the environmental education curriculum in senior high schools and environmental conservative mind of students in the first grade of Zhanjiang No. 20 Middle School

1.1 Through a sample survey of 234 high school students in Zhanjiang City, Guangdong Province, it was found that the environmental conservative mind of high school students was generally at a good level. The results of Wang,Y.R, et to al. (2018) survey of senior high school students in Tangshan City were also good environmental conservative mind., and in specific comparison, the results of this survey are yet better. There are two main reasons for this situation: First, the content of the survey in this study is the familiar environmental knowledge and environmental activities around the students, so the students are more familiar with and get better scores; Second, the survey of Wang,Y.R et al. (2018). was conducted in 2018. In recent years, education in China has paid more attention to environmental education in primary and secondary schools, and students' environmental conservative mind. has been improved to a certain extent.

1.2 Further analysis shows that from the three dimensions of environmental conservative mind, attitude/affective about environment conservative is the highest rank which is in the Good level, followed by behavior/psychomotor about environment conservative, while cognitive/knowledge about environment conservative is the lowest.

The results of this study are consistent with the findings of Wang Jinbo (2018), which also confirms that high school students in China have good attitudes toward environmental protection and are willing to participate in environmental protection activities, only that students do not have enough knowledge about environmental protection because the environmental education curriculum has not been well developed and implemented. This problem should be emphasized in the subsequent environmental protection work.

2. Discussion on the development of environmental education curriculum based on community participation to promote senior high school students' environmental conservative mind .

2.1 Curriculum objectives

The development of an environmental education curriculum based on community participation is intended to make up for the shortcomings of previous environmental education curricula, and the objectives of the curriculum follow the Syllabus on Environmental Education Topics for Primary and Secondary School Students (2003) issued by the Ministry of Education of China.

The Syllabus on Environmental Education Topics for Primary and Secondary School Students points out that the environmental education curriculum aims to enhance students' environmental conservatism, guide them to pay attention to the environmental problems faced by their families, communities, the country and the world, and to correctly understand the interdependence among individuals, society and nature; to help students acquire the knowledge and skills necessary for the harmonious coexistence of human beings and the environment, and to cultivate environmentally friendly feelings, attitudes and values; and to encourage students to actively participate in decision-making and actions for sustainable development. students to actively participate in decision-making and actions for sustainable development and to become citizens with social practical ability and a sense of responsibility(Ministry of Education ,2003).

However, most of the previous environmental education curricula taught students to focus on energy conservation in family life and avoiding food waste, while there was less in guiding students to pay attention to the environmental problems facing the community, the country and the world. Therefore, the goal of developing an environmental education curriculum based on community participation is to guide high school students to pay attention to environmental issues facing their families, communities, the country and the world, and to encourage students to actively participate in decision-making and actions for sustainable development, which is conducive to the enhancement of students' environmental conservative mind in a more comprehensive way. The results of this study are consistent with those of Niu Zhifang (2006), and Intarasompun, W., Muangnual, P., and Punchatree, N. (2022).

2.2 Curriculum contents

Environmental education materials have a wide range of environmental protection topics to choose from. The content of environmental education curricula needs to be "localized" in the first place, based on local resources, and the most appropriate teaching materials should be selected according to the objectives of the curricula. At present, there are some environmental education courses that are not "localized", for example, in the southern part of China, when students are taught about plant afforestation in the desert to resist sandstorms, most of the students in the southern part of the country have never seen a desert, and the teaching effect is not good enough. However, students in the coastal areas of the south are familiar with garbage pollution in the ocean and also know mangrove forests. Therefore, the teaching content can start from these aspects, so that the teaching content can be closer to the students' lives, and the students will be more interested and more likely to understand and apply what they have learned. The results of this study are consistent with those of Zhu Qian Hua (2006) and Tosati, S. ., Sitthisopasakul, T., and Intarasompun, W.(2021), the research findings all prove that environmental education curricula should be localized.

The five topics selected for the content of the environmental education program developed in this study are all accessible to students in Zhanjiang City, Guangdong Province, in their daily lives, so students are particularly motivated to participate in the environmental education program.

2.3 environmental education model

The environmental education model is a hot research topic of domestic and foreign experts and scholars. At present, among the countries that have done relatively well in environmental protection and environmental education, the United States and Japan have adopted the "school-community" environmental education model and achieved good environmental education results（Xiao,2009）.

"School-community" environmental education refers to the combination of schools and communities for environmental education; it can also be said to be school-led community environmental education, that is, relying on schools to take the lead in carrying out environmental education and then achieve penetration and radiation to the community. Students learn by actively.For example, environmental education activities in primary and secondary schools in the United States are often carried out in farms, countryside, parks or forests（Xiao,2009）.

The "community participation" of this study is mainly reflected in two aspects: 1). The "community" acts as an educator, providing environmental education to middle school students and outputting environmental education knowledge. Taking school education as the leading position, fully exploring and utilizing high-quality environmental education resources in the community, using them as a carrier and learning pathway for environmental education, supplementing and expanding school environmental education, forming a teaching model that combines "school - community". For example, schools can hire mangrove management bureau, Bird Watching Society, ecological environment bureau, writers' association The Artists Association and experts from nearby villages in the Mangrove Reserve give lectures and guide practical activities. 2).The "community" acts as an educated person, accepting the promotion of environmental education achievements of middle school students and inputting environmental education knowledge. For example, the school collaborates with the community (street office) to carry out community environmental protection publicity and volunteer service activities, promoting the results of environmental education activities in the community. Such volunteer service activities can enhance the environmental conservative mind of community residents, while also consolidating students' environmental education knowledge. Moreover, they can cultivate students' spirit of volunteer service, make them more deeply aware of their responsibilities as citizens, and promote students' sense of social responsibility. The results of this study are consistent with those of Li Jiusheng(2004),research has found that community participation in environmental education is very important.

2.4 Teaching Arrangement

The environmental education curriculum based on community participation is divided into 5 units of lectures with a total duration of 25 hours, and Adoption of a teaching model that combines theoretical courses with practical activity courses.

3. Discussion on the implementation effect of environmental education curriculum based on community participation.

There was a significant difference between senior high school students' pre-test and post-test levels of environmental conservative mind, The data show an increase in the average value of environmental conservative mind, from 3.80 to 4.21.This result indicated that the environmental education curriculum based on community participation can promote senior high school students’ environmental conservative mind. This also proves that the use of integrated practical activities is a good model for environmental education.

From the three specific dimensions , it is evident that, Behavior/psychomotor about environment conservative has made the greatest progress,

This reflects the most important feature of this study is that each unit participated in hands-on activities that are more appealing to students. The results of this study are consistent with the findings of Wichean Intarasompan, Jittawisut Wimuttipanya (2021), and Xiao (2009) that significant improvement in the senior high school students' environmental conservative mind has been achieved through the form of integrated practical activities with community participation.

Based on the above discussion, we can find that according to the educational syllabus of environmental education topics for primary and secondary school students , combined with the characteristics of "localization" environmental education, and based on the actual situation of students' communities, fully utilizing the resources and strength of the community, designing environmental education curriculum based on community participation is popular among senior high school students and can effectively improve their environmental conservative mind.

Recommendations

1.Applicability of results

1.1 Extension to other schools in coastal cities in southern China. Extend our environmental education curriculum to other schools so that more students can benefit from it. Introduce the results of our activities to other schools and share successful experiences through lectures, demonstration classes, and experience sharing sessions.

1.2 Training environmental education teachers: Our environmental education curriculum materials and activity results can be used to train new teachers for environmental education curriculum . By training teachers to improve their knowledge and teaching methods of environmental education courses based on community participation, more teachers will be able to conduct environmental education courses in a more targeted and effective manner.

2.Future Research

2.1 Continuing to improve and develop supporting teaching materials: Based on the results of the research, appropriate teaching materials or readers will be prepared so that more students can have access to environmental education programs. These teaching materials can include basic knowledge of environmental protection, practical cases, activity suggestions, etc. to meet the needs of students at different grades and levels.

2.2 Establish a web-based platform: Establish a web-based platform to provide resources and practical experience related to environmental education programs for more schools and teachers to access and use. The platform can include functions such as curriculum materials, teaching videos, case sharing, and interactive exchanges to facilitate exchanges and cooperation among teachers.

2.3 Further assessment of the effectiveness of environmental education curriculum based on community participation. Through further research, we can evaluate the effectiveness of the environmental education curriculum based on community participation in different school years (elementary, middle, and high school). This can cover a wider range of student groups due to a full understanding of the impact of this theory-plus-practice, school-plus-community teaching model on different types of students.

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