Research on the Integration of Inquiry-based Approach into the Environmental Education of Sustainable Development

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Abstract. According to the Organization for Economic Cooperation and Development (OECD), environmental literacy is an expected result of environmental education. Therefore, in the field of education, it is necessary and very important to raise the level of environmental education and to raise awareness of environmental protection. Physical education is a curriculum that is practiced by people. The purpose of this research is to design a physical education curriculum based on an inquiry-based approach and integrate environmental education issues to achieve sustainable educational goals. Therefore, in the design, we must first understand the environmental issues and then understand the exploratory teaching activities of physical education. Through the three main stages and the five main elements of the teaching process, stimulate students' critical thinking about environmental problems, and use physical activities to solve the environment. In this course, expanding the content of physical education teaching also breaks through the traditional teaching methods based on traditional sports skills, making physical education more meaningful. Finally, it is suggested that during the course implementation, students should pay attention to students' problem solutions and provide reflection diary after class to observe the students' environmental literacy learning curve.

1. Introduction
The world is facing serious environmental imbalances, such as climate anomalies, global warming, rupture of the ozone layer, air pollution, acid rain and fog, and other endless problems, which not only seriously threaten human life but also threaten future generations. Environmental education was originally a field of ecology and nature. Once economic, social and cultural factors were incorporated, the impact on human survival seemed to gradually expand. This is also a concern of education for sustainable development. Therefore, the relationship between environmental education and sustainable development education has become one of the hot issues [1]. According to the Organization for Economic Cooperation and Development (OECD), environmental literacy is an expected result of environmental education [2]. In other words, the important goal of environmental education is to develop environmental literacy. If students have rich experience in environmental protection, they will often improve their environmental education literacy and naturally promote environmental protection.

Taking teachers as an example, the research results of Dada, Eames, and Calder (2017) show that
pre-service teachers' environmental literacy can be achieved only by writing a dissertation, which will increase the confidence in teaching environmental education. [3] Besides, schools often teach students how to do a good job of sorting garbage. Government garbage trucks also use a sorting method to recycle people's garbage. Finally, many shopping malls have also responded to reducing the use of plastic products. Therefore, starting from environmental education in daily life, it will gradually affect socio-economic activities. Therefore, environmental education in schools has a profound impact on social culture.

Improving education and environmental awareness is necessary and very important. Physical education is a practical course. How to combine environmental education with sports is a teaching challenge. Rodrigues & Payne (2017) pointed out that the Australian Federal Government requires physical education courses. It is also believed that environmental protection is conducive to the integration of education and environmental issues, so people have called for the development of natural activities and outdoor / adventure education sports.[4] Combining these practical environmental issues with outdoor sports can achieve ecological responsibility and social sustainability. Therefore, the main purpose of this study is to design a physical education curriculum exploration activity to integrate environmental education issues to achieve sustainable education teaching methods.

Some education researchers believe that physical education can not only solve students' physical health problems but also provide students with opportunities to actively participate and develop unique cognitive abilities. Contemporary query technology-based teaching technology is considered a positive, engaging, and effective student-centered approach to physical education.

Therefore, the theme of this study mainly includes the following three aspects: (1) Understand the content of the environmental education curriculum; (2) Understand the context and significance of exploratory teaching; (3) Design a curriculum combining exploratory physical education and environmental education topics. In summary, this study discusses three main issues:

1. What are the current issues in environmental education?
2. What is the status quo of exploratory teaching in the design of the physical education curriculum?
3. How to design environmental education issues in the physical education curriculum?

2. Literature reviews

The development of civilization has promoted many well-beings of human life, but also caused many disasters, and threatened people's quality of life at any time, and even affected health. Therefore, human activities have a negative and positive impact on the environment. To find a solution to environmental problems, Akçay & Pekel (2017) pointed out that raising personal environmental awareness and behavior is one of the effective solutions.[6] Therefore, through education, it will promote the development of personal environmental awareness and obtain positive environmental protection and lasting impact. Due to the importance attached by developed countries in the world, it is believed that environmental education must be included in the curriculum of education, which will inevitably generate personal environmental awareness and development behavior.[7] Therefore, the research literature mainly discusses the teaching methods of environmental education in the current physical education curriculum design and provides a good reference for the subsequent exploratory physical education curriculum design.

2.1 Research on Environmental Education Issues and Education Curriculum

In recent years, people's awareness of environmental protection has been increasing, and environmental issues have been incorporated into the social, economic, and cultural fields of education in various countries, causing people to pay attention to environmental education issues in various education fields. Therefore, in the teaching method of environmental education, it is suggested to adopt different teaching methods to improve students' environmental literacy and enhance their environmental awareness and practical behavior. For example, research by Granit-Dgani, Kaplan, and
Flum (2017) states that the goal of education is that learners can write “short reflective writing and coding exercises,” which will promote learners' understanding of environmental content and promote sustainable Individual and collective responsibility. In other words, if students understand the content of the environment, they will immediately take environmental action and often discuss and discuss environmental issues. This teaching method is by using a critical thinking writing method and focusing on environmental education, in addition to transferring knowledge to individuals, it also takes responsibility and often works for the global environment.

Besides, some schools are trying to incorporate environmental education into formal basic curricula to build sustainable educational development. For example, a school in the Philippines divided environmental education into basic education courses. The subject of this course has some important environmental concepts such as climate change, waste management, species protection, and disaster risk strategies. These are included in the "science" curriculum to achieve the Sustainable Development Goals. However, it is also recommended that schools establish an environmental youth organization (YES-O) to strengthen the integration of environmental concepts and supplement their environmental protection curriculum plans to achieve better environmental protection results. Therefore, with this kind of environmental education program, the future course design of this research will consider issues such as climate change, waste resource management, and species conservation to achieve sustainable education goals.

The teaching curriculum does not use textbooks as a means of transmitting environmental education knowledge, but rather uses media television, the Internet, or newspapers and magazines to teach environmental education. With the current flood of knowledge information, students need to identify or explain the correct environmental protection knowledge in the media. In particular, the power of mass media can exacerbate students' attitudes or perceptions of the environment itself. For example, according to research surveys, in the face of news analysis from the media, 84% of students can identify and think useful. Therefore, changes in such teaching methods are effective for enhancing students' learning and environmental protection attitudes. In this study, it was pointed out indirectly that critical thinking can promote students' environmental protection behaviors. This teaching method that stimulates students' thinking is one of the important teaching methods to guide students to have a good environmental attitude and behavior.

2.2 Research on Exploratory Teaching and Physical Education

In contemporary teaching technology, inquiry learning is considered a positive, engaging and effective student-centered teaching method that can be applied to physical education. Research by Lynott & Bittner (2019) shows that physical education educators can effectively use exploratory teaching methods to develop motor skills, cognitive skills, and understand important and meaningful learning in life.[11] In other words, this expression means that exploratory sports are no longer based on traditional sports, but can be integrated into meaningful and important things in life, providing students with opportunities to learn and practice.

In Brazil's integrated environmental education and physical education teaching, adventure activities are often used as a strategy to change the teaching methods of environmental education.[12] [13] With the cohesion of the team, people's attention and dialogue on environmental education can be effectively promoted, because such adventure activities will require participants to participate in thinking and solving environmental problems, and through continuous practice and experience, will substantially improve people and nature.

Sustainable development that interacts and creates future environmental protection potential. Some scholars point out that the place of environmental education practice is the best in the real environment, and it will be closer to nature. Scholars from the Dominic, Panaute, Carus, Passafaro, Perugini, and Bones (2017) noted that they exercised in outdoor environmental education programs in local nature reserves to test students' environmental attitudes and behaviors. The research results show that students have increased their attachment to nature reserves, maintained intimate behavior with the environment, and promoted close relationships with their parents.[14] Therefore, combining
environmental education with physical education in a real environment will promote the sustainable attitudes and behaviors of students and their loved ones. Therefore, the Inquiry-based approach in the physical education curriculum can integrate the level of environmental education. In teaching activities, directly enter the real environment or simulate a real learning place, and the learning method should focus on exploration. Under the joint solution of natural environment problems, learners naturally improve their awareness and behavior of environmental protection.

3. Course design philosophy

Environmental education originated from the United Nations Conference on Human and Environment in 1972 and promulgated the "Human Declaration", which aroused people's attention to environmental issues. The world began to pay attention to and study environmental education, and then "The World Commission on Environment and Development (WCED) also released" Our Common Future ". The 1992 Earth Summit put forward Agenda 21, making environmental education a human education goal. World citizens should The agenda includes environmental awareness and sensitivity, environmental conceptual knowledge, environmental values and attitudes, environmental action skills and environmental action experience, principles of environmental education implementation including integrity, lifelong education, interdisciplinary integration and the ability to actively participate in problem-solving: Educa
tion It includes five categories: alertness (consciousness), knowledge (knowledge), attitude (attitude), skills (skills), and participation (participation).

Based on five environmental education provided by UNESCO, they are integrated into physical education. In the past, consciousness, knowledge, attitudes, skills, and behaviors were often linked together in a single linear pattern, which meant that whenever a student needed to teach and whether students produced environmental behaviors, these links provided a good reference for the behavioral model of the instructor. How can teachers simplify the design of some teaching strategies and activities so that students can truly understand the concept of environmental protection through classrooms and games, to achieve the purpose of these five environmental educations.

Inquiry-based teaching models include Bruner (1961) 's exploratory learning (discovery learning) theory and Osborn (1968)' s cumulative learning, as well as constructivism, which many contemporary educators have recently appreciated. To have the critical thinking, exploratory teaching methods must go through three stages (beginning, promotion, and thinking) and six elements (problem sets, organizational collection, interpretation and analysis, result evaluation, communication, and reflection). Based on this composition that stimulates critical thinking, this research constructs a critical thinking sports exploration teaching activity (see Figure 1).
4. **Curriculum design results**

The lesson plan for this unit is 12 sessions of 50 minutes each. There are 2 lessons per week, and the target is high school students.

4.1 **Curriculum Theme**: Environmental Education Issues-Taking Climate Change as an Example.

4.2 **Teaching objectives**:

- **Cognition**:
  1. Understanding the importance of climate change and global warming.
  2. Pay attention to the impact of climate change on life, society and the environment.

- **Feelings**:
  1. Able to respect students’ opinions and discuss and solve environmental problems together.
  2. He can really express his views on environmental protection through a small diary.
  3. Pay attention to the impact of human behavior on the global environment.

- **Skills**:
  1. Be able to use multiple methods to obtain information and solve exchange protection strategies.
  2. Able to practice environmental protection in daily life.
  3. Able to formulate carbon reduction plans and work hard to implement them.

4.3 **Course contents**

| Environmental Education Issues | Session | Learning Target | Sports Content |
|--------------------------------|---------|-----------------|----------------|
| Carbon Reduction               | Section 1 | • Understand the purpose of energy saving and carbon reduction. | Egggrab activity |
|                                |         | • Can tell how to save energy in daily life and be willing to do it yourself. | |
|                                |         | • Use the egg grab activity to bring the correct energy-saving | |
carbon detection leads back to the group.

| Section | Activity |
|---------|----------|
| Global Warming | Pharaoh |
| Abnormal Weather | Single bridge |
| Climate Change | Run on thin ice |
| Disasters and Carbon Reduction | Elephant crossing the river |
| Global Warming | Blind man crossing the cave |
| Global Warming | School orienteering |

- Understanding global warming and climate change
- Use Pharaoh games to understand the factors of warming and climate change.
- Ability to identify abnormal weather events (emergency weather, sudden rain disaster, drought, cold damage) and understand the cause.
- Use the read no bridge game to learn about unusual weather events.
- Be aware of the impact of climate change on life, society and the environment.
- Be aware of the increase in the frequency and impact of natural disasters.
- Can take advantage of activities such as thin ice to practice carbon reduction actions.
- Be aware of the impact of climate change on life, society and the environment.
- Be aware of the increase in the frequency and impact of natural disasters.
- Can use elephant crossing activities to implement carbon reduction actions.
- Be aware of the impact of human behavior on the global environment.
- Know the main factors contributing to global warming through blind man's cave activities.
- Be aware of the impact of human behavior on the global environment.
- Understand the main factors contributing to global warming through targeted activities.
5. Conclusions and recommendations

The design of this course states that the goal of environmental education is to develop environmental literacy, and its purpose is to improve students' educational literacy. In the education process, continuously provide awareness, knowledge, and through specific practical activities, develop the educational purpose of students' sustainable environmental education attitudes and behaviors. Secondly, the design of this research curriculum includes three important elements: environmental education issues, the content and steps of exploratory education, and the teaching of physical activities. Through the three stages and six elements of the activation process, students can stimulate critical thinking, conduct full discussions during the activity, and solve problems through physical exercise. In addition to innovative teaching activities in sports activities, it also promotes sports activities to become more meaningful activities. Finally, the following two points are suggested during the event. First, teachers must provide and urge students to reflect on their behavior after class so that they can better understand their students' environmental awareness. Secondly, when carrying out problem-
solving activities, we must pay attention to students' problem-solving methods, and teaching safety is the primary consideration.

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