A study of energy saving and carbon emission reduction education policy in Taiwan

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ABSTRACT: The purpose of this study was to explore and analyse the content of energy saving and carbon emission reduction for grade one to six students in a nine-year joint curriculum. A literature review and a panel discussion were employed in this study, and the study led to the following conclusions: 1) the content of energy saving and carbon emission reduction for grade one to six students in the nine-year joint curriculum was not complete, and most of them were repeated in different learning areas; 2) the issue of environmental education in the nine-year joint curriculum was including of more complete content of energy saving and carbon emission reduction; 3) the content of energy saving and carbon emission reduction in the issue of environment education was emphasised on developing students' competency in protecting the environment and exploring how to save energy, but teaching the concepts of how to implement carbon emission reduction was lacking.

INTRODUCTION

Energy saving and carbon emission reduction are an important issue in the world, and it is also related to the sustainable development of humanity and the earth [1-3]. In order to protect our environment and prevent humans in Taiwan from the damage caused by natural disasters, more and more countries are doing their best to solve the environmental problems [4][5].

Among these environmental problems, the most important one was trying to save energy and to reduce carbon emissions. When it was mentioned in the energy saving and carbon emission reduction policy, the Ministry of Education in Taiwan also listed the energy saving and carbon emission reduction policy as one of the most important policies [2]. For example, the Executive Yuan approved the *Framework of Taiwan's Sustainable Energy Policy* in 2008, and proposed three targets for Taiwan's sustainable energy policy [6]. In addition, in the energy saving and carbon emission reduction education policy, the Ministry of Education and the Ministry of Economic Affairs announced in October 1995, the rules relating to enhancing energy education in the elementary and secondary schools [2]. Therefore, Taiwan did place emphasis on setting energy saving and carbon emission reduction education into action.

In addition to previous efforts, more and more position papers put their emphasis on exploring energy saving and carbon emission reduction education. Huang tried to analyse the historic background of energy saving and carbon emission reduction, and proposed the possibility of implementation from the aspect of educational goals, related theory, curriculum, instruction and assessment [2]. Huang and Sue also shared their experience in setting energy saving and carbon emission reduction into action in their schools [7].

Meanwhile, Chang applied content analysis to explore the environmental values infused in the nine-year joint curriculum. Chang found that the rationale of the learning field of science and technology is compatible with the goals and instruction of environmental value education [8]. Although Chang mentioned the value of implementing the energy saving and carbon emission reduction through the natural science and living technology learning area, it was still hard to know that the content of energy saving and carbon emission reduction was complete or not for the science teachers, technology teachers, or all people that concerned this important issue.

Therefore, the purpose of this study was to explore and analyse the content of energy saving and carbon emission reduction for grade one to six students in the nine-year joint curriculum. According to the results of this study, the educational authorities will have more concrete direction in revising the education policy of the nine-year joint curriculum for the purpose of protecting the environment.

RESEARCH DESIGN AND IMPLEMENTATION

Research Methods

This study focused on exploring the energy saving and carbon emission reduction education policy in Taiwan. A literature review and a panel discussion were employed in order to explore the appropriateness of the content of energy saving and carbon emission reduction for grade one to nine students in the nine-year joint curriculum.

Participants

There were seven professional members invited to be in the panel discussion. Among these seven, two were professors from two different universities, and the other five members were teachers with over ten years teaching experience in elementary schools. All professional members discussed the appropriateness of the content of energy saving and carbon emission reduction for grade one to six students in the nine-year joint curriculum, and proposed their suggestions for the purpose of enhancing the content of energy saving and carbon emission reduction for grade one to nine students.

Research Procedure

There were seven major steps in this study (see Figure 1). The literature review was the first research step, and the related literature on energy saving and carbon emission reduction were collected and analysed for the purpose of developing the draft for analysing the energy saving and carbon emission reduction education policy for the panel discussion.

In order to ensure the validity of this study, seven professional members were invited to participate in this study, and the researchers set the following criteria in selecting the professional members: 1) professional experience in the field of energy saving and carbon emission reduction; 2) teaching experience in the field of energy saving and carbon emission reduction; and 3) an understanding of the properties of energy saving and carbon emission reduction. After the confirmation of the professional members, the panel discussion was convened, and the results of discussion were reconfirmed for proposing more appropriate conclusions.

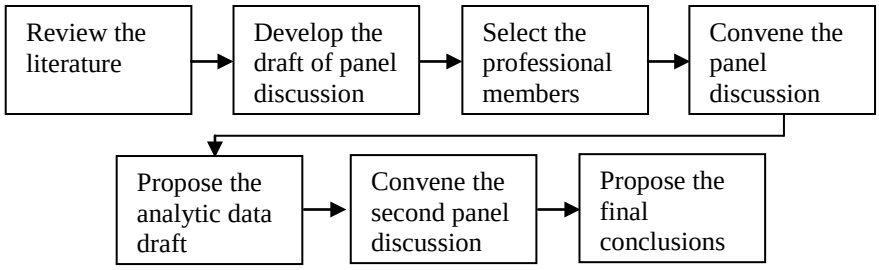

Figure 1: The research procedure.

RESEARCH RESULTS AND DISCUSSIONS

With the trends in educational reform, Taiwan has made many changes at the elementary and junior high school levels. For the purpose of coherence and integration, a so-called *nine-year joint curriculum* was created [9]. The nine-year joint curriculum focused on establishing the basic competency indicators of seven learning areas for grade 1-9 students instead of developing curriculum content outlines in the usual manner. Taking living technology as an example, the basic competency indicators in technological development for grade 1-6 students are shown in Table 1.

Table 1: Competency indicators in technological development.

Grades	Category	Competency Indicators
3 & 4	The Nature of Technology	• To understand the importance of technology in daily life. • To be aware of the characteristics of technology.
	Technology and Society	• To feel the mutual relationships between personal life and technology. • To know the products in common use in our daily life.
5 & 6	The Nature of Technology	• To know the classification of technology. • To understand machines and tools, materials and energy.
	The Evolution of Technology	• To know the technology in the area of agriculture. • To know the technology in the area of industry. • To know the technology in the area of information. • To know the internal and overseas invention and innovation in technology.
	Technology and Society	• To understand the traffic and leisure facilities in common use in the community.

In addition to the competency indicators in the nine-year joint curriculum, six important issues were included in the nine-year joint curriculum. The six important issues were *human rights education*, *gender education*, *home economics education*, *environmental education*, *career development education* and *information education*. Therefore, environmental education was also included in the nine-year joint curriculum, and the teachers in the seven learning areas had to integrate the environmental education issue in their curriculum content.

Therefore, in order to analyse the content of energy saving and carbon emission reduction in the nine-year joint curriculum, the seven learning areas and the issue of environmental education should be taken as the major research content. The results of analysing the content of energy saving and carbon emission reduction in the seven learning areas in the nine-year joint curriculum are shown in Table 2. The content of energy saving and carbon emission reduction in the seven learning areas for grade one to six students in the nine-year joint curriculum was not complete, and most of them were repeated in different learning areas.

Table 2: The analysis of the content of energy saving and carbon emission reduction in the seven learning areas in the nine-year joint curriculum.

<table>
<tr><th>Learning Areas</th><th>Grade 1-2</th><th>Grade 3-4</th><th>Grade 5-6</th></tr>
<tr><td>Living (Grade 1-2)/Natural Science and Living Technology (Grade 3-6)</td><td>To propose the important environmental problems and take responsibility of protecting the environment.</td><td>Not available</td><td>To explore the properties of oxygen and carbon dioxide, the making of oxygen, the understanding of combustion, oxidation, the making of carbon dioxide, the property of soluble in water, and air pollution, etc.</td></tr>
<tr><td rowspan="3">Society</td><td rowspan="3">To propose the important environmental problems in the daily life.</td><td>To explain the damage, disappear, regeneration or creation of resources.</td><td>To explain the environmental damage and regional environmental change, and propose the solutions.</td></tr>
<tr><td rowspan="2">To explain the development of science and technology, and the impacts of changing human life and natural environment.</td><td>To explain the inter-relationships in the global ecology environment, and propose the solutions.</td></tr>
<tr><td>To list the current common and concerning issues in the whole world.</td></tr>
<tr><td>Health and Physical Education</td><td colspan="2">To realise that humans were part of the natural environment and to consider the environment actively.</td><td>To investigate and analyse the environmental problems and its relationships with human health in the daily life.</td></tr>
<tr><td rowspan="2">Integrative Activities</td><td>To understand and appreciate their environment around.</td><td rowspan="2">To give an example for explaining the content of protecting and improving environment activities.</td><td rowspan="2">To explore the possible danger for changing and destroying environment, and discuss how to protect or improve environment.</td></tr>
<tr><td>To realise the relationships between environmental protection and themselves.</td></tr>
</table>

As for the analysis of the content of energy saving and carbon emission reduction in the issue of environmental education in the nine-year joint curriculum (see Table 3), it was not difficult to establish that the issue of environmental education included more complete content of energy saving and carbon emission reduction, including how to implement the issue of environment education in the seven learning areas. This will be an important issue in the near future.

According to the results of panel discussion, one of the professional members found that the content of energy saving and carbon emission reduction in the issue of environment education was over-emphasised on developing students' competency in protecting the environment and exploring how to save energy. It lacked teaching of the concepts of how to implement carbon emission reduction. Therefore, the content of energy saving and carbon emission reduction in the issue of environmental education in the nine-year joint curriculum was also not so complete, and still needed further improvement.

According to the previous analysis of the seven learning areas and the issue of environmental education, the results showed that the education policy of the nine-year joint curriculum was not so complete in arranging the content of energy saving and carbon emission reduction. So if the educational authorities want to set energy saving and carbon

emission reduction into action, the content of energy saving and carbon emission reduction should be carefully re-examined.

Table 3: The analysis of the content of energy saving and carbon emission reduction in the issue of environmental education in the nine-year joint curriculum.

Issue	Grade 1-2	Grade 3-4	Grade 5-6
Environmental Education	To realise the environmental problems in school and home.	To realise their own living styles' impacts on the environment.	To observe, experience the nature, and utilise different form in expressing the beauty of natural environment and the concern of nature.
	To execute environmental activities in their daily life.	To realise the impact of environmental problems in their daily life around.	
		To record the regional environmental problems.	To realise the local and international environmental issues.
		To compare the characteristics of regional environmental issues in Taiwan.	To realise the global environmental issues.
			To understand the mutual relationships between human and the environment.
		To realise the mutual relationships between person and environment in the daily life.	To learn to concern the disadvantaged minorities and their living environment.
		To concern the environment of school and community actively.	To get into the habit of thinking internal and international environmental issues.
		To understand and respect the different provincial origins' attitudes and behaviour to the environment.	To concern the future generation's existence and sustainable development.
		To generate and consider the environmental problems in different region.	To listen and propose questions reasonably in facing the environmental issues.
		To draft an environmental protection plan for the community.	To collect the internal and international environmental issues and strategies actively by utilising different media
		To analyse and evaluate the reasons of regional environmental problems in Taiwan.	To utilise scientific methods in researching possible solutions in solving environmental problems.
		To utilise the simple technology and information in realising the environmental and related issues.	To utilise the scientific instrument in distinguishing, analysing and understanding the environment around.
		To possess the experiences of participating, investigating and solving the environmental problems in the daily life.	To participate in the environmental protection activities in the school organisations and community.
		To execute simple environmental investigation activity through the environmental protection activity in school.	To possess the experience of participating regional and international environmental issues survey, research and solving problems.
		To execute the green consumerism, saving energy and saving water.	To form the team and learn and plan to solve environmental problems by adopting democratic autonomy process.

CONCLUSIONS AND SUGGESTIONS

This study focused on exploring the content of energy saving and carbon emission reduction for grade one to six students in the nine-year joint curriculum. According to the results of the panel discussion, the following research conclusions and suggestions were made:

1. The content of energy saving and carbon emission reduction for grade one to six students in the nine-year joint curriculum was not complete, and most of them were repeated in different learning areas.
2. The issue of environmental education in the nine-year joint curriculum included more complete content of energy saving and carbon emission reduction, but how to implement the issue of environment education in the seven learning areas will be an important issue in the near future.
3. The content of energy saving and carbon emission reduction in the issue of environment education was emphasised on developing students' competency in protecting environment and exploring how to save energy, but lacked teaching of the concepts of how to implement carbon emission reductions.

According to these conclusions, the researchers hope that the approach of examining the education policy can be offered to the researchers of other countries, and that the content of energy saving and carbon emission reduction in the nine-year joint curriculum can also be taken as an important reference.

ACKNOWLEDGEMENTS

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