Cultural Determinants of Learning Outcomes
in Global Environmental Education

by

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ABSTRACT

There is evidence of increasing deterioration of the natural environment on a world-wide scale over the last few decades. Elementary teachers play a crucial role in implementing environmental education to foster global citizens who will be able to actively sustain a healthy planet. The purpose of this study is to explore the obstacles that inhibit teachers from accomplishing the goals of environmental education, and what teaching strategies could reduce those obstacles. Grounded theory approach is used to collect and analyze data from students' and teachers' surveys. Differences are found in the teachers' perceptions, cultures and educational philosophies between British Columbia and Taiwan, and these affect the implementation of environmental education. A theory is formulated to relate cultures to the learning outcomes of global environmental education. Recommendations for both BC and Taiwanese Ministries, school policies and teachers are presented, as are specific recommendations for future research.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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Our global future depends upon sustainable development. It depends upon our willingness and ability to dedicate our intelligence, ingenuity, and adaptability— and our energy— to our common future. This is a choice we can make.

Our Common Future, 1987

When you drink water, remember the spring.

Chinese proverb

CHAPTER ONE: OVERVIEW

Introduction

> Global change, though a dramatic and potent reality for human beings, is still an extremely difficult phenomenon to conceptualize mainly because of the complexity of the dynamics and the number of issues involved. However, if educators, keeping in mind the holistic nature of the problem as well as the interrelations of the individual issues that go to form it, set their sights on the attainment of the goals of environmental education i.e. awareness, attitudes, skills, motivation, commitment and ethical responsibility, they will be well on the path to the formation of environmentally responsible citizens of tomorrow (UNESCO, 1993, p. 4).

Upon reading the goals of environmental education addressed in the UNESCO newsletter "Teaching global change through environmental education", a guideline for the world-wide environmental education, I was impressed by the powerful statement that environmental education should be a practical tool to profoundly influence global citizens to actively sustain a healthy planet.

For the past four decades, I lived in my homeland of Taiwan, in which an increasing population with rapid economic growth has produced severe environmental problems (Environmental Protection Administration, 1988). I have become seriously concerned about the deteriorating environment. As a Taiwanese social studies teacher of thirteen years, I became convinced of the essential importance of educating children to raise their awareness, help them to acquire knowledge, clarify values, weigh alternatives and develop solutions to environmental problems, so that they may assume responsibility for improving the situation.

Moreover, I also became concerned that in Taiwan many teachers seem to spend little time on teaching about the environment. Is it because of personal lack of interest, or are there obstacles that prevent their deeper involvement? In contrast, when I saw environmental education in a British Columbia classroom I noted many differences in approach and wondered if they were significant or trivial differences in the sense of how they affect the children's learning.

Historically, Canadian environmental education developed earlier than that of the Taiwanese. In the early 1970s the Canadian federal and all provincial governments passed legislation regarding environmental issues. In education, courses, programs, textbooks and other resource materials have greatly improved since then. However, education in Canada is solely the responsibility of provincial governments. There is no federally mandated curriculum. In contrast, the Taiwanese National Parks Department of the Ministry of the Interior, established in 1981, launched the nature conservation movement and extended environmental education. Starting in the mid-1980s, interdisciplinary environmental programs were introduced and mandated by the Ministry of Education into the curriculum at all levels of education in Taiwan, from elementary school to university. Beyond this general difference, I wondered if there were cultural differences affecting teachers' goals of environmental education as well as students' learning outcomes. To explore the cultural determinants of learning outcomes in global environmental education, I embarked on this study.

Rationale

> Since children at the primary level are particularly susceptible to the formation of the proper values and attitudes, their educational programmes should systematically include contents and activities favouring the development of a social ethic emphasizing preservation of environmental quality as a major component in the quality of life and well being at both the national and the global level (UNESCO, 1985b, p. 3).

This passage emphasizes that elementary teachers play a crucial role in implementing environmental education and influencing students to foster the planet's future well-being. Many studies illustrated in Chapter 2 contain convincing arguments on the importance of teaching environmental education at the elementary level.

There are three main points that provide a rationale for this research. First, it is important for teachers to educate children to adopt an environmental ethic. The Ministry of Education in the province of British Columbia believes that, "by including environmental education in the learning... students would begin to realize how the environment is connected to all aspects of their daily lives" (B.C. Ministry of Education, 1995a, p. 6). Through teachers' effective instruction, it is hoped that students will begin to take personal responsibility for adopting a more environmentally sustainable way of life in order to restore and protect our environment. Second, it is likely that there are at least some similarities between British Columbia and Taiwanese teachers of various teaching backgrounds because they have some common educational philosophies and social needs. These common socio-educational experiences suggest that teachers of different backgrounds are likely to exhibit some similar responses to their shared

experiences of teaching environmental education. The third point in support of this study is that the differences of environmental education between British Columbia and Taiwanese teachers are likely as great as the broad differences between Canadian and Taiwanese cultures. By seeking insights from both groups, we may identify common problems or valuable ideas that translate across cultures.

This study uses the grounded theory approach described in Chapter 3, to develop an inductively derived theory grounded in data collected about cultural determinants of learning outcomes in environmental education. The study focuses on grade six teachers in Taipei and Victoria concerning their teaching of environmental education. The sixth grade is the most suitable because it is the ultimate and last stage in Taiwanese elementary education and its social studies textbook includes a unit on environmental education. In both BC and Taiwan, environmental education is included in Social Studies. The *Taiwanese Grade Six Social Studies Textbook* (Taiwanese Ministry of Education, 1995b) emphasizes many scientific concepts, however, such as ozone depletion, acid rain and global warming, which may not be familiar to the social studies teachers who must teach them. Thus Taiwanese grade six social studies teachers are likely to encounter difficulties to teaching environmental education and must develop some capacities and effectiveness to reduce them. I wondered what difficulties confront British Columbia teachers concerning environmental concepts included in the curriculum.

This study focuses on the **social studies** teachers' implementing of environmental education because social studies, rather than science, brings in the

social action component which fits the goals of environmental education addressed by UNESCO (1993, p. 4).

The Purpose of the Study

The purpose of this study is to explore what obstacles inhibit teachers at the grade six level from accomplishing the goals of environmental education, including the opportunity for students to acquire knowledge, clarify values, weigh alternatives and develop solutions to global environmental problems. This study focuses on the environmental component of global education. The distinction between global education and environmental education is described in Chapter 2.

This study also compares perceptions of British Columbia teachers and Taiwanese teachers towards their goals, obstacles and effective strategies in instructing environmental education. In addition, the differences in cultures and educational philosophies between British Columbia and Taiwan are used to analyze the implementation of environmental education. Finally, through the qualitative analysis of data, the study develops a grounded theory for understanding the cultural determinants of learning outcomes and discusses some implications and recommendations.

The Research Questions

My concern is that environmental education does not appear to be as advanced in Taiwan as in BC. In order to develop a theory of the implementation of environmental education across cultures, I set out the following questions:

1. What are the teachers' goals in environmental education?
2. What obstacles do the teachers perceive as inhibiting them from accomplishing the goals of environmental education?
3. What effective teaching strategies could improve the implementation of environmental education in elementary school classes?
4. What cultural differences between British Columbia and Taiwan affect the implementation of environmental education?

The Design of the Study

There are four sources of information for my analysis:

1. Taiwanese students' and teachers' surveys.
2. Literature review described in Chapters 2 & 4, including the comparison of British Columbia and Taiwanese social studies curriculum guides.
3. Personal reflections on my teaching experiences in Taipei and observations in British Columbia schools. I bring to this study my understanding of the Taiwanese culture, and as an Award winning teacher in Taipei, my experience in implementing Taiwanese curriculum. Having lived in Victoria for four years,

I have had the opportunity to visit and observe classes in environmental education. My personal reflections supplement the survey responses and are identified as personal comments.

4. Interviews and surveys of ten BC and ten Taiwanese grade six teachers of environmental education. These teachers were selected on the basis that they were recommended as outstanding and committed, by principals in Taipei and graduate students in the environmental education program in Victoria, respectively.

Significance and Limitations

This study is important in several respects. The information gathered in this study may add to the general knowledge base and understanding of the obstacles to effective environmental education at the grade six level. From their participation, the teacher subjects may be able to clarify their personal goals and effective strategies as well as gain insights and strategies from the results of other interviews and differences between two cultures. By analyzing their own situations they may also reduce some obstacles that they face. It is hoped, therefore that this study will contribute to effective education to restore and protect our environment.

This study explores new territory in comparing BC and Taiwanese teachers, and may provide insights to improve the effectiveness of instruction in global issues.

The study was limited to twenty teachers and restricted to two cities, Victoria, Canada and Taipei City, Taiwan. Further, the selection of teachers was limited to those known as outstanding in the field of environmental education. The obstacles faced by less qualified individuals would be worth exploring in a subsequent study.

Due to the fact that the participants of this study lived in different continents, interviews were possible only with the British Columbia participants. Interviews were used in British Columbia to assist the researcher in understanding the English responses, and to verify that the questions elicited the information sought. The Taiwanese teachers were surveyed by mailed questionnaires with follow-up by telephone. Thus, this study was also limited by the possible bias of the researcher who translated the Taiwanese teachers' descriptions to the questionnaire in English, analyzed the data from different cultures, and evaluated the findings by her own interpretation.

From this study I hoped to develop a theory of the cultural determinants of learning outcomes in global education.

CHAPTER TWO: LITERATURE REVIEW

Introduction

This review is organized around five major themes: 1) the key concept of global education; 2) environmental education as a strand of global education; 3) the importance of developing a global environmental perspective in the elementary grades; 4) the possible obstacles to implementing environmental education in elementary schools; 5) participation and action orientation as an important characteristic of environmental education; and 6) the cultural context of Taiwan and British Columbia. These themes are reviewed in this chapter in order to provide both a theoretical and practical basis for this study.

Global Education

Over the past three decades, as the world has become increasingly complex and interdependent, people have had to respond to many problems and issues of global proportions. Global education has generated and emphasized the need for people to develop effective relationships with others and to understand prevailing world conditions, the process of change, and emerging trends (Kraus International Publications, 1992, p. 201). The content of a global education is composed of four elements: global problems and issues; global systems; human values; and the history of contacts and interdependence among peoples, cultures and nations (Kniep, 1986, p. 437).

Interdependence is the key concept in global education (Edmisten, 1985). This concept of mutual dependence stresses the interrelatedness of and the connections, consequences, and vulnerabilities among natural social systems; it underlies all other concepts (Ellis, 1991, p. 317).

Based on this key concept, there is a natural link between global education and social studies, including the study of how people relate to their social and physical environments. Case and Fowler (1995) emphasize that how social studies and global education mutually reinforce each other is determined by how the two studies are conceptualized (p. iii). That is, a successful social studies program could empower students and produce enlightened global citizens.

Environmental Education as a Strand of Global Education

Environmental education is one of the four strands of global issues and problems, which are commonly listed as environment, development, peace and human rights (Kniep, 1986). The definition of what constitutes environmental education continues to evolve. According to Swan and Staff (1974), environmental education is the process of producing a citizenry that is knowledgeable concerning the total environment and its associated problems, aware and skilled in how to become involved in helping to solve these problems, and motivated to work toward their solution (p. 49).

However, the key concept, interdependence, characterizes the structure of environmental education and the perception of the relationships between individuals and the human-environment. As Ignatieff (1984) has stated, "the

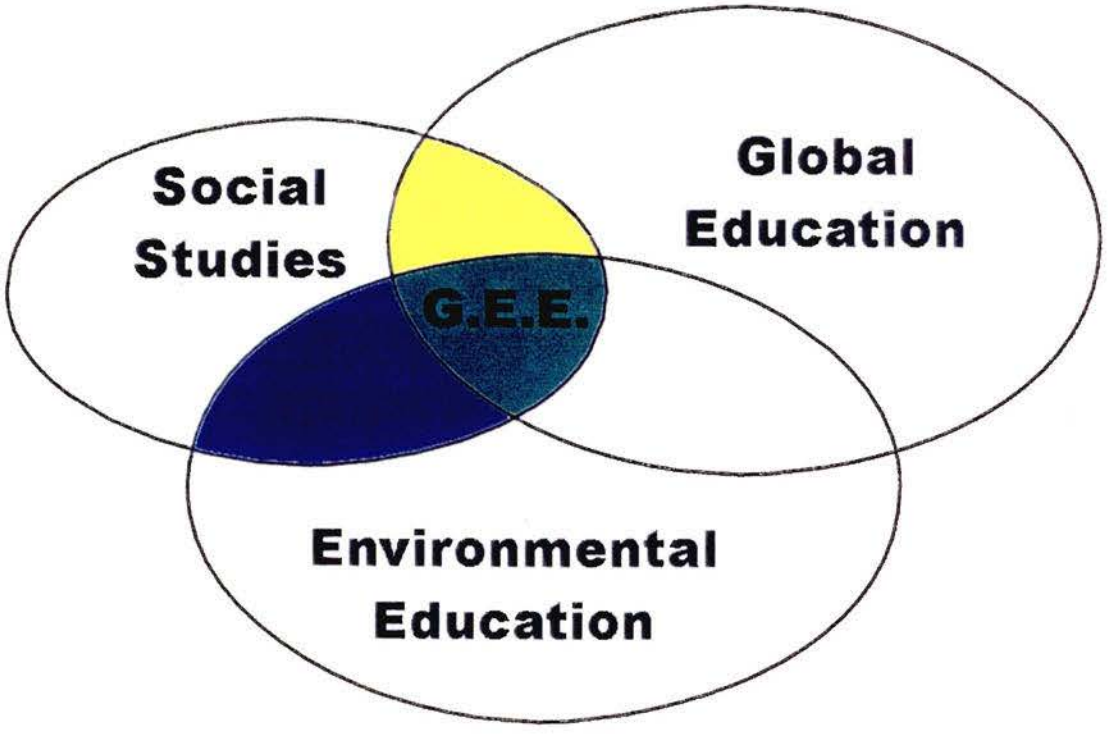
ecology in which we live and breathe is global " (p. 29). The following figure illustrates the relationship between environmental education and global education.

Figure 1. Global Environmental Education among Environmental Education, Social Studies and Global Education

Concerning global issues, such as development, peace and human rights.

Concerning global environmental issues, such as global warming, ozone depletion and acid rain.

Concerning local environments, such as pond study, aesthetics, natural resources and geography in Canada and Taiwan.



Environmental Education in Social Studies Classes

Environmental knowledge refers to the factual information that individuals have about the ecology of the planet, and the influence of human actions on the ecology. This concept is usually taught in social studies, science and science-technology-society courses at the secondary level, with social studies emphasizing the human factors and solutions.

For example, the need to reduce emissions of green house gases in order to end global warming is one of the challenges facing industrialized countries (Russo, 1997). The physics, chemistry and biology are appropriately covered in science, while the social changes needed should be included in social studies teaching and learning (Cherryholmes, 1991. p. 45). In classes, teachers might cite specific examples from anywhere in the world to illustrate environmental issues (e.g., deforestation and air and water pollution). The goal is to help students realize that they have to look to themselves as individuals able to effect change, and to encourage more responsible attitudes toward caring for our global environment (*Social Studies & the Young Learner*, 1998).

Global environmental education highlights the importance of the research question: How do we save the planet from the global environmental problems we face? Hayes (1998) claims that a good environmental education should teach our students "to be ready to invest in building positive futures for the communities to which they belong -- household to global" (p. 17). This environmental concept embedded in a global dimension, is essential in the study and described in the next section.

What is a Global Environmental Perspective ?

According to Case (1995), a global perspective refers to a point of view or lens for viewing people, places and things around the world (p.19). There are many potentially useful ways of nurturing a global perspective in elementary students through cultural, political and socio-economic points of view in Canada and the wider world. Teaching for a global perspective can easily occur through units on food markets, transportation, communication, home and home life around the world (Jarolimek, 1986), "sister city" arrangements, scouting groups, ethnic associations, cultural exchanges (Ellis, 1991), or even through an exciting globingo game (Pike & Selby, 1988).

In addition, a global perspective focused on an environmental point of view, as McClaren (1995) states, could raise awareness among people to global environmental issues, build knowledge of global ecosystem principles, clarify values about personal behaviors and help people develop action-taking skills. That is, promoting a "global environmental perspective" might directly enlarge our perception of the whole world and our relationships to people.

This perspective, which provides the rationale for all curricular decisions concerning the development of environmental education, involves the definition of long-term global goals and appropriate, effective means for pursuing them (Hungerford, Peyton, & Wilke, 1980). Not only could proposing solutions to global environmental problems, such as ozone depletion, global warming and acid rain engage students in developing a global environmental perspective, but appreciating the importance of our environment and the need to work with others

around the world is also an efficient tool to nurturing a global environmental perspective.

An example of children contributing to the lives of their peers in another area of the world is that of the students of Sunnyside Elementary School in Pullman, Washington, who sympathized with Nicaraguan villagers hauling water from remote, unclean, and open water holes. Collecting cans to recycle, the American children raised enough money to buy several rope pumps for the villages (Franz & McLane, 1996). In this case, as Darling (1995) cautions, students need to have a sense of why this environmental knowledge is valuable and how it relates to their participation in the world as responsible citizens. Thus, developing a global environmental perspective for students would be a key to fostering the planet's future well-being.

The Importance of Developing a Global Environmental Perspective in the Elementary Grades

According to Ellis (1991), the years of middle childhood, roughly the ages 7 to 12, may be the ideal period for developing a global perspective. During this time the child is moving from what Piaget terms "egocentric" thought to more "sociocentric" thought, in which the child considers the broader consequences of his or her actions, not only personally but also for others as well; the child becomes able to understand perspectives other than personal ones (p. 317).

Considerable research also indicates that environmental education programs

have their greatest influence in childhood (Cohen & Hollingsworth, 1973; Duran, Guerin, & Sarnowski, 1974; Miller, 1975; Pomerantz,1986; Monroe & Kaplan, 1988; Simmons & Widmar, 1990; Keen, 1991). These authors comment that elementary grades are a crucial time in children's international socialization and learning of environmental knowledge. After an introduction to environmental education in social studies class, children might perform their local environmental actions in a more thoughtful, meaningful and purposeful manner, which would be beneficial to developing a global environmental perspective.

Not only could teachers employ clearer and fuller knowledge and effective teaching strategies to help students to develop a global environmental perspective, they could also assist and inspire students to become global citizens. Nevertheless, very few studies have involved developing a global environmental perspective for children.

Relative Paucity of Studies Involving the Development of a Global Environmental Perspective of Children

Many educators (Case, 1995; Darling, 1995; Selby, 1995; Werner & Case, 1996) believe that developing a global perspective is essential, and many researchers (Maloney & Ward, 1973; Lowe, Pinhey & Grimes, 1980; Albrecht, Bultena, Holberg & Nowak, 1982; Van & Dunlap, 1983; Chou & Roth, 1995; Hsu & Roth, 1996) have extensively focused on environmental knowledge. In addition, many studies (Ramsey & Rickson, 1976; Richmond, 1976; Perez, 1987;

Brody, 1990; Hungerford & Volk, 1990; Cheung & Taylor, 1991; Leeming, Dwyer & Bracken, 1995; Ballantyne & Pacher, 1996; Hsu & Roth, 1996; Cottrell & Graefe, 1997) also found that developing children's environmental knowledge could positively influence their attitudes and behaviors. However, too little has been reported about the importance of taking a global environmental perspective with younger students.

Conversely, some research (Armstrong & Impara, 1991; Leeming, Porter, Dwyer, Cobern & Oliver, 1997) reveals that the effects of an environmental education program are diluted by numerous other demands on elementary school teachers and students. Apparently, there are some obstacles stemming from both students and teachers. These are the issues I turn to next.

The following is a brief summary of environmental education in BC and Taiwan.

Table 1. Overview of British Columbia Grade Six Social Studies: A Sample

Organizers	Key Content
Environment	• world geography • settlement and population patterns in various countries • relationship between environments, economies and resources
Society and Culture	• relationship of culture to needs and environment • study and appreciation of world cultures
Politics and Law	• global citizenship • the United Nations- human rights • systems of government and rights and responsibilities in various countries
Economy and Technology	• mass media stereotypes of cultural groups • economic relationship between Canada and Pacific Rim countries
Applications of Social Studies	

Source: B.C. Ministry of Education (1996b). *Social Studies K To 7 Integrated Resource Package* (Draft). pp. 4-5. Victoria: Ministry of Education, Curriculum Branch.

Note: Copies of relevant pages of the IRP are in Appendix M.

The sole unit of environmental education taught in the Taiwanese grade six social studies classrooms is uniform for the entire country. The topics covered are listed below. The goals, methods and resources indicated in the teacher guide are also around these topics.

Table 2. Lesson List of Taiwanese Grade Six Social Studies Textbook: A Sample

Unit 1: Our Global Village

Lesson 1: The causes of our global village
Lesson 2: Rapid growth of the world population
Lesson 3: Rapid development and misuse of technology
Lesson 4: The imbalance of ecological environment ---(1) misuse of resources
Lesson 5: The imbalance of ecological environment ---(2) environmental pollution :
Ozone Depletion
Changes of the Earth's Climate
The Disaster of Acid Rain
Lesson 6: What ideas people should have to solve global village problems
Lesson 7: Creating the ideal global village

Source: Taiwanese Ministry of Education (1995b). *Taiwanese Grade Six Social Studies Textbook*, pp. 2-3. Taipei: Taiwanese Ministry of Education. (Translated by Hui-Mei Tsai)

Possible Obstacles to Implementing Environmental Education in Elementary Schools

Let me review possible obstacles to implementing environmental education in elementary schools, as they have been identified in the literature.

Obstacles for Students

Lack of Ecological Knowledge

One reported obstacle to introducing environmental education content is the belief that elementary school students are not capable of learning the concepts of ecosystem and change (Ellis, 1991). Some research (Rejeski, 1982; Brody, 1990) indicates that it is not until ages thirteen to fourteen (middle school) that students begin to understand basic ecosystem concepts. That is, before grade six, students do not understand many of the critical relationships in ecological systems.

In the British Columbia curriculum, much of the environmental or ecological material is found in the physical science section of the grade seven *Integrated Resource Packages*, and in grade eleven and twelve biology (B. C. Ministry of Education, 1996a). Many social studies teachers, however, introduce environmental education principles throughout grades one to seven.

Lack of World Geographic Knowledge

A second obstacle may be that elementary school students lack world geographic knowledge. Global environmental issues obviously have a geographic component -- they must be discussed in terms of their locations. In the BC

curriculum, world geography is found in the environment section of the grade eight *Integrated Resource Package* (B.C. Ministry of Education, 1996b, p. 4), although introductory concepts appear from grade four. This situation is the same as the Taiwanese curriculum. As a result, grade six students are likely to have only rudimentary world geographic knowledge, and thus may have difficulty dealing with global environmental issues (Kirman, 1991).

Lack of Knowledge Concerning Current Events

Current events enhance students' global perspectives and ability to analyze facts and opinions that they encounter (Ellis, 1991, p. 325). They also promote students' environmental knowledge (UNESCO, 1976; Hart, 1981). The daily news from newspapers or television carries some environmental information, such as for example, the signing in Ottawa of an international treaty to ban anti-personnel land mines ("Land mine ban crusaders," 1997), and an editorial on Canadians playing a global role in facilitating the treaty (Sullivan, 1997).

Historically, mass media, such as radio, television and the press, has carried much of the environmental information used frequently by the public (Bowman & Hanaford, 1977; Ostman & Parker, 1986), especially newspapers (Furlow, 1994), and television news (Brothers, Fortner & Mayer, 1991).

Not only does mass media play an essential role in environmental communications (Simmons, 1987), but it could also help students analyze facts and opinions that they encounter. Blum (1987a), in his study of students' sources of environmental knowledge in four countries, asserts that mass media is the most

important influence on students' judgment of the seriousness of different environmental issues. Also, Pomerantz (1986) found that fifth graders, whose primary source of information about environmental knowledge came from magazines, had high levels of environmental knowledge.

Unfortunately, according to Statistics Canada, 1993, most elementary school students are more interested in watching television drama (29.6 %) and comedy (25.8 %), than they are in watching the news (6.8 %) (p. 27). Further, they seldom read daily newspapers (Statistics Canada, 1997, p. 81). Thus elementary school students' background knowledge may be insufficient to appreciate global issues. Therefore, as Hunkins, Jeter and Maxey (1982) state, social studies teachers must continue to act as a source of information and to present information (p. 43).

Obviously, teachers play a crucial role in transmitting environmental education, which includes the obligation of providing elementary school students with the basic and fundamental knowledge that is required for making sense of complex global environmental problems and issues. However, there are also other reported obstacles, such as lack of knowledge and time, inhibiting social studies teachers from accomplishing the goals of environmental education.

Obstacles for Teachers

Lack of Knowledge

Research (Mirka, 1973; Buethe & Smallwood, 1987) suggests that most elementary social studies teachers do not have enough knowledge of

environmental problems and issues to tackle the task alone. For example, if scientists cannot totally agree on the causes and mechanisms of global climate change (Broby, 1990, p. 32), how can elementary social studies teachers be expected to understand complex global phenomena, such as global warming and ozone depletion? On this point, Blum (1987b) in his article "Think Globally, Act Locally, Plan Centrally" asserts that teachers without the necessary knowledge base, may offer trivial, superficial, indoctrinating or misleading teaching (p. 5).

However, this weakness of elementary social studies teachers in transmitting environmental knowledge can be reduced by keeping abreast of issues carried by the mass media. For example, Pomerantz (1986) suggests that magazines can be used to a greater extent by teachers in the classroom as an effective environmental education tool. Fergusson (1998) also indicates that there is a vast amount of information available on the Internet and that teachers can urge students to explore research sites, and to download, analyze and graph data for their projects. Nevertheless, teachers may be inexperienced in using technologies such as computers, audio and video equipment which can be powerful tools in effective social studies teaching and learning (Rose & Fernlund, 1997; Sembor, 1997).

Lack of Time

According to Ham and Sewing (1988), the primary barrier to teaching environmental education is time. Developing a comprehensive, usable curriculum

with specific objectives really requires sufficient time to prepare materials and lesson plans.

However, the most effective teachers whose classes made the greatest gains used particular and practical procedures. Some examples are that effective social studies teachers can use current events to open up or extend their students' awareness of global environmental problems and issues. They can also capitalize on multimedia materials in planning a particularly interesting lesson of environmental education, instead of several pages on it in the textbook. With effective preparation in environmental education teaching methods and careful planning of classroom management and assignments, teachers can stimulate interest in the topic and enthusiastically prompt student responses. Several researchers offer recommendations for effective teaching (Darrow, 1964; Lee, 1974; Peterson, Kromrey, & Borg, 1990; Wang, Haertel, & Walberg, 1993; Raviv & Reisel, 1993; Lane, Wilke, Champeau & Sivek, 1995; Rosenshine, 1995). As Stanley (1991) concludes in a study, increasing teachers' competence for social studies education will require technical, practical and critical expertise (p. 259).

Participation and Action Orientation as an Important Characteristic of Environmental Education

In addition to the possible obstacles of teaching environmental education as many researchers suggest, participation and action orientation, which are critically important characteristics of environmental education, are likely to have been overlooked by numerous environmental education programs and projects

(Childress, 1978). Hungerford, Peyton & Wilke (1980) have warned that the lack of emphasis on helping students actually solve environmental problems is contrary to the recommendations for environmental education objectives contained in both the UNESCO Belgrade Charter (1976) and Tbilisi Intergovernmental Conference Report (1978).

The British Columbia Ministry of Environment (1980) has given teachers an insight into primary environmental education which "should allow the child to expand the horizons of his or her personal experience and can take place within every subject area"(p. 6). In addition, the British Columbia Ministry of Education (1995a) offers a framework for introducing environmental concepts into the classroom that is based on the six principles (discussed in Chapter 4), and puts an emphasis on direct experience and responsible action as: "It is important for students to understand the variety of ways in which action can take place and the consequences of different strategies"(p. 16). Also, in the *Social Studies K To 7 Integrated resource Package* (B.C. Ministry of Education, 1996b) students are encouraged to apply their understanding to contribute to the sustainability of global ecosystems and communities as actively participating citizens (p. 2). In fact, British Columbia school students have been taking actions to conserve and protect the environment in various ways (see Table 3). Notably, Belvedere Elementary School was recognized as an Earth School (more prestigious than a Green School) after completing one thousand environmental projects through more than seven years of effort (Green Schools, 1998).

Table 3. Examples from the Literature of Action Education Related to Global Environmental Issues in British Columbia

Schools	Projects	Participants	Events
Langdale Elementary School	Sunshine School districts "Cool Schools" program	Grades 4 to 7	Teach children skills critical to positive social interaction so that students can take responsibility for working out their conflicts, function as members of their own communities, and take action globally. (Jovick, 1993)
Peace River South Schools	"Destination Conservation" Program	Students, staff, teachers, parents, custodians, and principals	Students plan conservation strategies and activities. They have been shutting off unnecessary lights, using both sides of the paper, remembering to put things in the blue box, and bringing no-garbage lunches to school. (Ferguson, 1994)
Ridgway Elementary School	"The Refuge"	Students, staff, teachers, and parents	Students grunted and dug holes to built a refuge in an unused courtyard in the center of the school. They created new paths to explore the space, and built a deck and a pond. They observed the subtle seasonal changes, and birds drinking from the pond. A grade 3 student rescued a plant and planted it in the refuge, when her rented home was demolished. A grade 4 student built a bird house and autographed his peers' journal entries describing the sparrow event. The refuge grounds students in a sense of a place, a critical construct in developing an environmental ethic. (Heath, 1995)

(Continued on the next page)

Table 3. (Continued)

Schools	Projects	Participants	Events
Sangster Elementary School	Esquimalt Lagoon Project	Students	Teach students to respect the lagoon and its environment where more migratory birds will frequently habit. e.g., grade seven students test the lagoon water quality. (Lee, 1996)
Port Moody Elementary School water	"Destination conservation"	Students, teachers, and custodian	Inspect their school's hearing system, insulate hot pipes and hot water heaters to reduce energy consumption. The reduction of greenhouse gases can lead to substantial economic as well as environmental benefits. (Yohemas, 1997)
Bayside Middle School	Earth Day Fair	Students, teachers, parents, and residents.	Celebration of work being done to help preserve our environment. Recycling and composting. (McCullock, 1998)
Quarterway Elementary	Environmental Monitoring Project	Grade 6 students	Making rain collectors, collecting the rainwater twice a week for eight weeks, and doing testing with a pH meter in the classroom. (Hameister, 1998)

In the *British Columbia Assessment of Social Studies 1996 Technical Report* (B.C. Ministry of Education, 1997), students exhibit a range of positive attitudes on social issues such as environmentalism (p. XIV). Students "show enlightened, progressive and inclusive attitudes towards participation in society"(p. 99) when they were asked to respond how often they participate in activities related to community improvement (for example, writing a letter to the editor, raising money for a good cause, or helping a neighbor).

McClaren (1995) points out that the abilities to take appropriate action and work cooperatively with other people are two of the ten elements of environmental literacy viewed from a global perspective. Not only are participation and action orientation important characteristics of environmental education, but they are also key stages to developing a global environmental perspective in elementary school students.

The Cultural Context of Taiwan and British Columbia

The previous review of research literature derived from the Western point of view focuses on how Canadian teachers develop students' commitment to act in implementing environmental education. However, is this way appropriate to Taiwan in order to save the planet from the global problems we face? This question led me to look for the differences between Taiwan and Canada. The Taiwanese population, approximately two thirds that of Canada, is crammed into a land area almost three hundred times smaller ("World Book," 1997, see Table 4).

Table 4. Comparison of Canada, Taiwan, Victoria and Taipei, by Area, Population and Density

	CANADA	TAIWAN	Victoria	Taipei
Area	9,970,610 Km^2	35,980 Km^2	157.07 Km^2	272 Km^2
Population	30,300,400	21,817,017	313,400	2,635,534
Density in persons/ Km^2	3	606	1995	9689

Sources: 1. Statistics Canada, CANSIM, Matrices 6367-6379 (on 07/01/98). Available Internet:http://www.StatCan.CA/english/Pgdb/People/Population/demo02.htm http://www.StatCan.CA/english/Pgdb/People/Population/demo05.htm
2. Statistical Data on the Republic of China (on 07/01/98). Taipei: Executive Yuan. Available Internet: http://www.taipei.org/info/98html/stat-e.htm http://www.ris.gov.tw/ch4/static/st1.html
3.. *The World Book Encyclopedia*.(1997).Chicago: World Book, Inc. Vol. 3,16,19 & 21.

The capital and largest city of Taiwan, Taipei, is one of the most densely populated cities in the world. Overcrowded housing and heavy traffic are the major problems in the city. Air pollution has resulted from motor vehicles and the factories in and near this highly urbanized and metropolitanized city. In contrast, Victoria, the vacation capital of Canada and the capital city of British Columbia, is well-known as the "City of Gardens". Thus, the differences between Taiwan and British Columbia might be profound in many ways including culture and education. Teaching environmental education in British Columbia is likely to be different from teaching in Taiwan. Let me now make a careful examination of Taiwanese culture before attempting to apply the Western view.

Taiwanese Culture

As early as the seventeenth century, Chinese came to Taiwan. After the Sino-Japanese War (1894-1895), the Japanese armies controlled the island for fifty years. When World War II ended, as had been promised at the Cairo Conference in 1943, President Roosevelt of the United States, Winston Churchill of England and Chiang kai-shek of China agreed that Taiwan should be returned to Chinese rule. Then, Taiwan became the 22nd province of China. In 1949 Chiang kai-shek and his followers from all over China retreated to Taiwan and maintained the government of the Republic of China in Taiwan until the present day.

Marsh (1996) states that since 1963 Taiwan has become one of the world's most outstanding examples of rapid and intensive capitalist economic growth, industrialization and urbanization. He conducted a survey in 1991 that replicated his 1963 survey, and found that the percent of respondents that are concerned about their obligations to parents, including studying and working hard and avoiding negative behaviors (those that cause parents to lose face), increased significantly from 1963 to 1991 (p. 93). This supported Schwartz's (1981) conviction that the Confucian tradition of filial piety is the keystone to family life in Taiwan.

According to the ancient Chinese classic, Li Chi, the highest filial piety is to honor the parents by achievements. In addition, Taiwanese, according to a common saying, "hope their son will become a dragon, and hope their daughter will become a phoenix". The term "dragon" in this context nowadays means success for the male in any endeavor; "phoenix" for the female means she will get

a good education, have a good career, and marry a successful man. That is, parents do not hesitate to take measures to enforce discipline for children to attain these goals. For example, in Marsh's (1996) survey the support for physical punishment among his respondents increased significantly from 53.4% in 1963 to 70.3% in 1991 (p. 286). Taiwanese society is very competitive in all sectors, so at each step in the life cycle children must do their best to move to the next stage of educational advancement. Taiwanese parents tend to be ambitious for their children and see the need for discipline as a means to their children's success. Undoubtedly, Taiwanese view education as they view the rest of life: a process of winning and losing. Furthermore, official cultural life in Taiwan is under the supervision of the Ministry of Education (Schwartz, Hammond & Ruqqiero, 1981). Thus, we need to take a closer look at Taiwanese education as described in the next section.

Taiwanese Education

While Taiwan was a colony of Japan (1895-1945), a system of universal primary education for grades one through six was instituted. The language of instruction was Japanese rather than Chinese. Under the government of the Republic of China, free education was extended from six to nine years in 1968, and made compulsory in 1982. Free education was extended to 12 years in 1993; the 10^{th} through 12^{th} years of free education are generally more vocational and employment-specific in orientation (Marsh, 1996).

Taiwanese students in elementary, middle and high schools attend school Monday through Saturday (half a day every other Saturday) for a total of 210 days of study per year(in contrast, British Columbia schools study 180 days per year [Renfrew Elementary School, 1998]). The school year runs from September to June, including a winter break from late February until the end of March. Elementary school students take required courses, including such subjects as social studies, math, science, art, music, language art and physical education, similar to those of Canadians. Other subjects include health education, life ethics and assembly. In weekly assembly, guests are invited by the school to give lectures.

The days are long for Taiwanese students. Elementary school students, for example, attend school from 7:30 a.m. until 4:00 p.m. (in contrast, British Columbia elementary schools lasts from 8:25 a.m. until 2:30 p.m., see Table 5).

Table 5. The School Day and School Year in British Columbia and Taiwan

School Day and School Year	British Columbia	Taiwan
Instruction Time per School Day	8:25 a.m. - 2:30 p.m. Six hours for Elementary	7:30 a.m. - 4:00 p.m. Eight and half hours for Elementary
Length of School Year	180 days for 1997/98	210 days for 1997/98

Source: 1. Renfrew Elementary School. (1998). School calendar. Available Internet: http://renfrew.vsb.bc.ca/current.html
2. Statistical Data on the Republic of China. (1998). Available Internet: http://www.taipei.org/info/98html/stat-e.htm

During the day, classrooms house an average of 40 students (in contrast, British Columbia elementary class size averages 23 students [B.C. Ministry of Education, 1998, Summer, p. 5]), sitting in wooden desks and chairs arranged in long straight rows. After school, most students attend private institutes in which they receive supplementary academic lessons. After returning home, they work on heavy homework and prepare for next days' tests or examinations.

An important link in this intricate system is private tutoring. In elementary school, students receive tutoring in such subjects as English, math and writing Chinese. While these tutoring sessions during the early years are mostly fun, once a student enters middle school the lessons become a vital component of his or her education. In Taiwan, both public and private schools must follow the national curriculum. High school in general in Taiwan is a serious matter. Admission to famous public high schools is extremely competitive, and students must meet rigorous entrance examinations and requirements to be accepted by them. Upon completion of high school, a student must not only have high grades, but also score very well on the National University Entrance Examination. Tuition in Taiwan's private universities is three times higher than in the public universities. It is considered even more important for children from poor and middle-class families than for the rich to pass the entrance examinations to get higher education.

Thus, parents support their children after school in attending cram schools (pu hsi pan) which attempt to prepare students for passing the entrance examinations for the better public universities (Marsh, 1996, p. 250). Fierce

competition for college entrance leaves its mark on students who fail their entrance examination, for they have done more than fail an exam; they have disgraced their families' honor. In Taiwan, we cannot deny that a strong family commitment and a demanding curriculum have been driving forces in Taiwanese students' enviable academic achievement. The achievement aspect of education is emphasized to transmit important skills and knowledge and select the most talented people to fill the more important occupational roles in society. The amount of education one has in Taiwan is for one's standing in the community (Marsh, 1996, p. 212). Education is therefore a channel of upward mobility in Taiwan (p. 249).

Education as an Important Tool for Taiwanese Social Change

According to Tumin (1985), education plays a major role in determining what occupation one will achieve and hence, in turn, the probable level of one's income. The more education one has, the more control will one have over one's destiny. In Marsh 's survey (1996) in Taiwan, it is notable that only education, not income or occupational status, had a significant effect for children of their future social class (p. 282). Compared to 1963, parents surveyed in 1991 believed even more strongly that one's children's chances of rising in the world had improved. Marsh (1996) believes that this trend in Taiwanese society, has resulted from the Taiwanese government's further improving educational levels by devoting more resources to education between 1971 and 1987

(Council for Economic Planning and Development, Manpower Planning Development, 1988, p. 7). The Taiwanese economic momentum, taking advantage of its continuing strong investment in education, has led to the rising age of marriage, giving women more years to work before assuming marital responsibilities, living independently from their parents, and having for fewer children as well. School attendance provides young people with access to new ideas and values. These new ways of looking at the world can come from the schooling process itself, as new ideas and attitudes are portrayed in the educational curriculum.

Thornton (1994) affirms that the educational achievements of children bring honor and prestige to the family, and enhance the well-being of both the children and the larger family chain, yet the tremendous pressure for high performance on formal examinations causes Taiwanese young people to spend considerable amounts of time studying (p. 91). Also, academic achievements of Taiwanese young people may not contribute to saving the Taiwanese environment.

Taiwanese Environment

According to Marsh (1996), since 1963 Taiwan's physical environment has been degraded by economic growth (p. 313). One public opinion poll showed that between 1983 and 1986, pollution moved from sixth to second most serious concern on a list of eight social problems, and from fourth to first among problems respondents expected to grow still worse in the future; however,

"Taiwan has no environmental movement -- only environmental episodes" (Reardon-Anderson, 1992, p. 87). One of the few environmental events, the Lukang rebellion in 1985, might be an informative example to review the relationship between Taiwanese culture and environment.

DuPont Taiwan Ltd., a wholly owned subsidiary of the American chemical giant, received permission from the Taiwanese government to build a titanium dioxide plant which was the largest single foreign investment in Taiwan's history and the largest by Dupont in the entire Far East (p. 5), but which would destroy the natural environment and residents' way of life in Lukang on the west coast of central Taiwan. The people of Lukang launched a fifteen month rebellion which ended when Dupont announced its withdrawal. Reardon-Anderson (1992) concludes that the leadership and the strong support from the maritime communities surrounding Lukang were the crucial aspects of the success of the rebellion. For example, the prominent leader Li Tung-liang who lacked formal education told reporters: "We are not members of any party or faction, or of any particular religion, or of any county or any locale. We just love our hometown and our county and want to protect our environment" (p. 60). The people of Lukang in simply trying save their hometown, achieved stunning success that no one else in Taiwan had ever done before.

Ironically, after the withdrawal by Dupont, the rebellion leader Li tried to mount a campaign against the Taiwan Chemical Factory in Changhua, but he attracted little support and soon abandoned the effort. A Taiwanese assemblyman responded in an interview with Reardon-Anderson (1992) that the most serious

problem in China which has done the most damage to the nation and public policy is the Chinese reliance on "human feelings" (jen-ch'ing-wei), the bonds of interpersonal obligation and concern that govern relations between people and the way they settle their disputes. For example, "[w]hen someone's factory pollutes his neighbor's home, the victim will insist on resolving the problem privately or through an intermediary in a way that preserves relations between the parties, rather than making the matter public" (p. 86). "Now in the Dupont case...these were foreigners who had no such relations and therefore lacked protection, so the whole thing could explode" (p. 87). Nien His-lin who left Lukang to work for the Greenpeace Environmental Workshop, responded to Reardon-Anderson (1992) that, "those of us who are active in environmental protection have no faith in political parties. Parties only want votes. They grab onto environmental issues in a short-term, opportunistic way, just to win elections. After the election, they have no interest in the environment". Reardon-Anderson (1992) recognizes that it is difficult to see how Taiwanese people can constantly develop an environmental ethic into a coordinated nationwide action to save their environment (p. 87).

Although education has been an important tool for Taiwanese social change during the past three decades, the Lukang environmental event reflects how, in Taiwan, there is no social and political consensus to use education as a tool to help save the environment. This highlights the questions: How do Taiwanese teachers implement environmental education in classes? Are there obstacles they encountered that inhibit Taiwanese education as a tool to save the environment? Before exploring these questions, we must take a closer look at teacher training.

Teacher Training

Requirements for a Taiwanese professional certificate in teaching are the same as in British Columbia: a five-year university degree including a four-year undergraduate program and a one-year teacher practicum (B.C. Ministry of Education, 1998, Fall, p. 16; Eastman, 1998). One of the differences between British Columbia and Taiwanese teacher licensing systems is the demarcation between the training of elementary and secondary school teachers. In Taiwan, there are nine National Teacher Colleges and three universities training elementary school teachers, and three National Normal Universities and thirty-six universities training secondary school teachers (Taiwanese Teacher Institutions, 1998; Taipei In-Service Teacher Training Center, 1997). Many of British Columbia's universities, including UVIC, UBC and SFU, train both elementary and secondary school teachers (B.C. College of Teachers, 1996).

Another difference is that British Columbia student teachers get teacher certifications from the British Columbia College of Teachers after they complete a one-year teacher certification program while Taiwanese students must pass a pencil-and-paper assessment of teaching skills, classroom management, and educational philosophies, a classroom-based assessment of teaching instruction, and an oral examination by the administrators of their selected schools after graduating from a five-year teacher education program, or a one-year teacher training program. After the schools accept them and determine that their teaching is satisfactory the schools then apply to the Ministry of Education for certification on behalf of the applicants.

One of the reasons that Taiwanese teachers are able to illustrate their instructions in classes is because there are many mandatory textbooks and teacher guides with which they have been familiar during their teacher education programs. In contrast, British Columbia elementary school teachers are used to collecting teaching resources to integrate many subjects and designing their own lesson plans. It is evident from the BC Assessment of Social Studies 1996 Technical Report (B.C. Ministry of Education, 1997) that teachers believe students learn well from full class discussion, library research and problem solving investigations, and "evaluation is most commonly based on individual research projects"(p. XV). School-wide and district-wide tests are not an important component of evaluating student learning (p. 125). Many North American teachers who have taught in Taiwan have found a lack of materials at most schools. Ultimately, many could not cope with the large burden of responsibility and were fired or moved on to other jobs ("The teachers' room," 1996).

Although there are many differences in the teacher training program of British Columbia and Taiwan, there is an aspect in common: the environmental education component is an elective in both teacher education programs (B.C. College of Teachers, 1996, pp. 16-17; National Taipei Teacher College, 1998). In contrast, in Nova Scotia, environmental studies has been regularized into the elementary school teacher certification requirements (Nova Scotia Department of Education and Culture, 1997, p. 8).

Even though environmental education is optional in Taiwanese teacher training, each teacher college has its own environmental education center, and an environmental education web site made by the Taiwanese Ministry of Education (1997a) not only provides teachers with effective instructions, such as outdoor environmental activities (Taiwanese Ministry of Education, 1997b), but also supplies environmental information, such as how to design school campuses for implementing environmental education (Environmental Protection Administration, 1997a) and how to combine students' field trips with their parents' leisure activities in order to facilitate outdoor environmental education (Council for Economic Planning and Development, 1997). Moreover, like the British Columbia Ministry of Education, the Taiwanese Ministry of Education (1995a, 1995b & 1996c) designed the grade one to grade six textbooks and teacher's guides in order to expand the learning environments from familiar subject matter such as children themselves, their schools and the local community to global issues (see Table 6 & Table 7).

Table 6. Overview of Environmental Unit Topics from British Columbia and Taiwanese Elementary Social Studies: A Sample

Grade	British Columbia	Taiwan
1	• Interaction with human and natural environments • Care of the environment	• Our school • Our lovely home
2	• Geography of British Columbia and Canada	• Environmental influences on our lifestyles • Our community
3	• Environmental influences on human activity	• Our homeland • Care of our homeland
4	• Continents and oceans • Interactions of people with their environments -- past and present	• Geography of Taiwan • National resources in Taiwan • Taiwan's environment-past and present
5	• Physical and political features of Canada • Natural resources in Canada • Sustainability and stewardship • Effects of lifestyles and industry on the environment	• Geography of China • Republic of China • Interactions of Chinese people with their environments
6	• Major world geographic and political features • Settlement and population patterns in various countries • Relationships among environments, economies and resources	• Major world geographic and political features • Our global village

Source: 1. B.C. Ministry of Education (1996b). *Social Studies K To 7 Integrated Resource Package*. Victoria: Ministry of Education, Curriculum Branch.
2. Taiwanese Ministry of Education. (1995a). *Elementary Social Studies Teacher's Guide* (in Chinese). Taipei: Taiwanese Ministry of Education.

Table 7. Overview of Environmental Unit Topics from British Columbia and Taiwanese Elementary Science: A Sample

Grade	British Columbia	Taiwan
1	• The Earth's surface • Plant and animal characteristics • Plant and animal life cycles	• Our beautiful campus • Plant and animal characteristics • Plant and animal life cycles • Making toys
2	• Plants in the environment • Animals in the environment	• Planting flowers • Little animals on campus • Raising pets
3	• Energy in our lives • Earth's composition	• Energy in our lives • Silkworms, soil and water
4	• Adaptation of organisms • The Earth's fresh and salt water resources	• Adaptation of organisms • The Earth's fresh and salt water resources
5	• British Columbia's living resources • British Columbia's non-living resources • Synthetic and natural materials in our world	• The microscopic world • Chemical and physical changes • Space exploration
6	• Classification of organisms • The microscopic world • Chemical and physical changes • Space exploration • The structure of the earth	• Classification of organisms • Our environment • Environmental problems and issues • Our home - the Earth

Sources: 1. B.C. Ministry of Education. (1995b). *Science K To 7 Integrated Resource Package*. Victoria: Ministry of Education, Curriculum Branch.
2. Taiwanese Ministry of Education. (1995c). *Elementary Science Teacher's Guide* (in Chinese). Taipei: Taiwanese Ministry of Education.

In Taiwan there are many quizzes and school-wide tests to assess students' environmental knowledge in every semester. Even in the essay-writing tests of high school entrance examinations, there are many environmental topics (see Table 8) used to evaluate students' skills.

Table 8. Essay-Writing Topics for Taiwanese High School Entrance Examinations (1992-1998)

Year	Taiwan Provincial Examination	Taipei City Examination
1992	Acting more benevolently (or Doing more good deeds)	Soil *
1993	Making the earth green again *	Tears and laughter
1994	If I were a junior student in a middle school again	A timely rain *
1995	More love	A day of abundance
1996	Being a responsible person	There are more important things than reading
1997	Cultivating an industrious and frugal habit	Making your life fuller and more worthwhile
1998	A personal opinion of examinations	The benefits of browsing in bookstores

Source: Hui-Mei Tsai (1998) collected and translated.
Note: * environmental topic.

Taiwanese students are likely to study the environment from textbooks, and demonstrate their understanding of the environment in writing as well. Although such an environmentally focused essay- writing test in Taiwan is usual and proper, it might cause negative feedback in British Columbia. This cultural difference determines the implementation of environmental education in both British Columbia and Taiwan and is described below.

Comparison between British Columbia and Taiwanese Implementation of Environmental Education

In the BC Assessment of the social studies curriculum (1996), an essay-writing test about students' feelings about home was designed to evaluate the skills of BC students in grade four, seven and ten, but raised ethical concerns such as getting disclosures from violating students' privacy (Danard, 1998). The Western point of view emphasizes the rights of individuals. As Linda Watson, second vice-president of the BC Teachers' Federation states, "They [the writers of the exam] could have chosen a subject that was less stressful" (p. 2). In contrast, using this universal subject of the home to elicit students' responses, is legitimately used in Taiwan. Moreover, Taiwanese students' weekly assignments, including writing journals to display their inner feelings, are regarded as an opportunity for teachers to understand students, and to help them avoid risks. This mandatory task of Taiwanese teachers to weekly monitor their students' situations is intended to maintain the students' emotional health and to prepare the students for social roles.

Unlike Taiwanese teachers, some BC teachers can choose to regard environmental education as a function of the whole curriculum, formal and informal(Park, 1983, p. 83). Despite this relative autonomy, studies (Wang, Haertel, & Walberg, 1990; Leming, 1991; Thornton, 1991; Schug, Western, & Enochs, 1997) indicate that in the past decades, teachers in Canada have depended heavily on textbooks, in which very little content exists on environmental education. However, in the *BC Assessment of Social Studies 1996 Technical*

Report (B.C. Ministry of Education, 1997), teachers show a great deal of reliance on newspapers, magazines and periodicals, rather than textbooks (p. 114), and use innovative teaching techniques most widely in elementary schools (p. 125). They also believe that "students view the textbook as less important to their learning than they did in 1989" (p. XV). As a result, there are fundamental structural and educational philosophy differences between BC and Taiwanese elementary education.

Fundamental Structural Differences

There are fundamental structural differences between Taiwanese and BC elementary education that are revealed in all subject areas. For example, Taiwanese teachers are required to use specified textbooks, teachers' guides and curriculum guidelines to emphasize the mastery of subject matter. They tend to treat the textbooks as an authoritative source of knowledge, and focus on what would be on the tests. Thus, students' homework, reading and assessments have been dominated by textbook-based and teacher-controlled recitation and lecture. In addition, Taiwanese teachers explicitly teach values education in classrooms in order to foster students' moral behaviors to be successful in a harmonious society as their parents expect.

By contrast, BC teachers are given suggested curriculum Integrated Resource Packages (IRP) to integrate subjects in their teaching. They emphasize direct experience, such as participatory education, cooperative groups, field

studies, play drama, simulations and case studies, in their instructions and assessment.

Educational Philosophy Differences

Beyond the general differences between British Columbia and Taiwanese education, there are also differences in educational philosophy that illustrate the advantages and disadvantages of teaching and learning environmental education in both cultures.

First, British Columbia teachers' autonomy is greater than that of Taiwanese. This is an advantage yet is also a disadvantage for both British Columbia and Taiwan. For example, the teaching time allotted by British Columbia teachers is most influenced by personal factors, such as interest and knowledge rather than by government mandate. Some teachers might teach students to use the Internet fully to do environmental research, thus integrating the subject over many hours. On the other hand, some BC teachers may choose not to emphasize environmental education in their classes. Students may learn an environmental topic more than once or not at all. In contrast, Taiwanese teachers have to transmit the mandated textbooks to students and thus must actually teach the environmental topics in the classrooms. Taiwanese students may learn environmental education at every level, but limited to the content of the textbooks, unlike British Columbia students who might get mass information of variable quality because it may not have been evaluated by experts.

Second, environmental education in British Columbia is more focused on an understanding of the natural environment and less on air, water and waste than in Taiwan. Having plenty of natural resources, British Columbia teachers may more easily develop students' aesthetic appreciation in implementing environmental education than Taiwanese teachers can. It is evident that in the BC grade six curriculum there are many topics of interconnectedness, organisms, nature study and salmonids. However, the Taiwanese people encounter a deteriorating quality of life so that they are sensitive to dealing with environmental problems, such as air pollution, water pollution and waste. These issues are most relevant to elementary school students, but they force Taiwanese elementary school teachers to teach abstractions, such as ozone depletion and global warming, which are deferred to a more advanced level in British Columbia. It also requires Taiwanese children to learn about and cope with the most depressing of environmental education issues.

Further, the ecosystem-centered educational philosophy in Canadian education differs from Taiwanese education that emphasizes a human-centered point of view. The Canadian view of environmental education is toward an appreciation of environment in its free state. In contrast, the Taiwanese approach is close to horticulture in which nature is seen as being dominated or subjugated. The man-nature orientation is represented by the mastery-over-nature alternative. For example, weeds which are thought as unwelcome intruders among cultivated plants, would be removed by the Taiwanese people, regardless of whether weeds are very valuable since many insects feed on them. Mosquitoes cause occasional

outbreaks such as dengue fever through Taiwan, a small, moist and subtropical island with a highly dense population. Thus, cleaning-up weeds on campus is one of the fundamental environmental education activities in the Taiwanese elementary school students' daily lives.

Summary

This review of the literature indicates that concerns about developing a global environmental perspective in the elementary grades are warranted and related to environmental education, social studies, science and global education. These concerns seem under represented in the literature. In addition, an important element clearly left out of the academic literature is whether with effective teaching strategies, teachers could overcome the obstacles of implementing environmental education.

This literature review also shows that there are significant factors which influence the implementation of environmental education, and determine learning outcomes in Taiwan and British Columbia. Finally, this review of the literature reaffirms the researcher's belief that it is essential and urgent that teachers help children to develop a global environmental perspective in order to foster the responsibilities of caring about the fragile global village, taking actions environmentally in their daily life, working collectively toward solutions of environmental problems, and building a better tomorrow.

CHAPTER THREE: METHODOLOGY

Introduction

As stated previously, this study is designed to explore elementary school teachers' experiences of teaching global environmental education at the grade six level, where very little has been reported about the implementation of global environmental education with younger students. Strauss & Corbin (1990) claim that a qualitative method called a grounded theory approach, is useful to uncover and understand what lies behind a phenomenon in the social and behavioral sciences about which little is yet known (p. 19). Thus, this study uses the grounded theory method to build a theory concerning the learning outcomes in global environmental education in two different cultures. This chapter outlines the grounded theory approach, the preliminary research, the data collection process and procedures followed, and describes the participants.

I have chosen the grounded theory approach because it permits me to develop a theory concerning the use of global education as a strategy to encourage Taiwanese children to assume an active role in responding to global environmental issues. A grounded theory is refined and modified through successive series of data collection and analysis. In this study I analyze information collected from students and teachers in Taiwan, formulate an initial theory, collect further information and analyze it before formulating a more complex theory of determinants of learning outcomes of global education in Taiwan.

Grounded Theory Approach

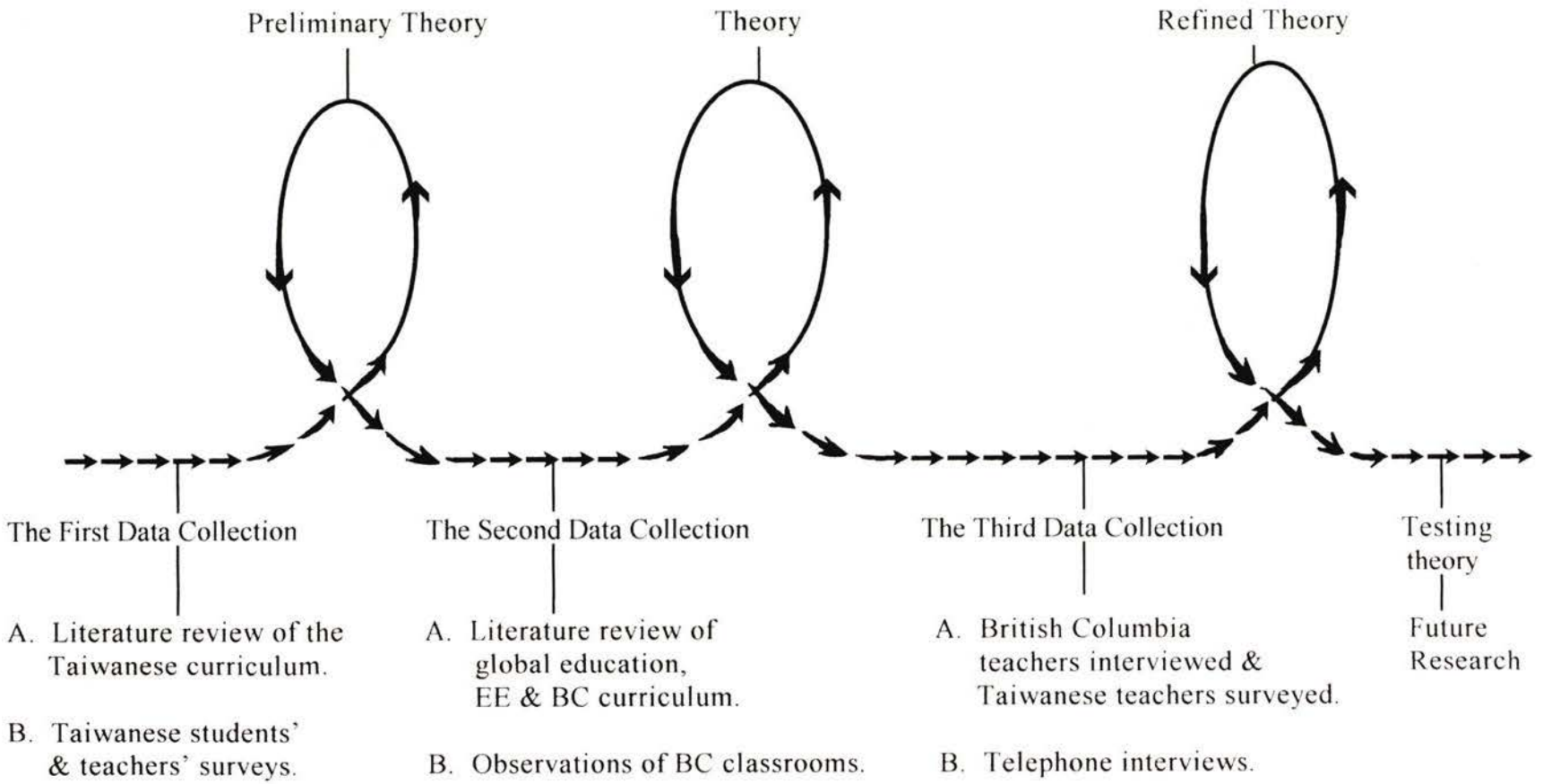
The underlying design used for the data collection and analysis processes in this study is a systematic set of procedures to develop an inductively derived theory grounded in the data collected and emerging from them (Merriam, 1988, p. 142). For the development of a grounded theory focused directly on the data, the constant comparative method is used in this study (Glaser & Strauss, 1967). In the constant comparative method, the researcher simultaneously codes and analyses data in order to develop concepts. Specific incidents in the data are continually compared as the researcher refines these concepts, explores their relationships to one another, and integrates them into a coherent theory (Glaser & Strauss, 1967, pp. 38-40).

According to Strauss & Corbin (1990), a very important requirement in grounded theory methodology is theoretical and social sensitivity to draw upon past experience and theoretical knowledge to interpret what is seen. The researcher needs astute powers of observation and good interactional skills to obtain valid and reliable data (p. 18). This sensitivity also helps the researcher to discover, develop and provisionally verify a grounded theory through systematic data collection and analysis of data pertaining to that phenomenon (p. 23). As a former Taiwanese teacher, I was familiar with the Taiwanese elementary social studies curriculum mandated by the Taiwanese government. This curriculum uses several elements such as standardized textbooks and teachers' guides, students' achievement testing, curriculum guidelines, materials selection processes, teacher certification requirements, educational information management systems,

graduation requirements, and school evaluation and certification. I was also aware that deterioration of the Taiwanese natural environment was making it less and less satisfactory for people ("Deterioration," 1997). Yet I wondered if the Taiwanese school students understood environmental problems and issues.

In particular, I was concerned about what obstacles inhibit teachers from accurately implementing environmental education programs designed and employed by experts (social studies education professors, university-based subject-matter specialists and curriculum developers). Strauss & Corbin (1990) indicate that personal and professional experiences are often the sources of research problems (p. 35). The grounded theory approach they recommend, tends "to be oriented toward action and process"(p. 38). That is, "data collection, analysis, and theory stand in reciprocal relationship with each other"(p. 23). In practice, data collection leads to developing and refining theory followed by further data collection. The following description outlines the spiral process of data collection and theory development used in this study
(see Figure 2).

Figure 2. The Spiral Process of Grounded Theory Applied to this Study



Overview

Grounded theory research methods are used for this study. The model used is the spiral process shown on page 50:

1. First data collection, including:
   A. literature review of the Taiwanese curriculum and,
   B. Taiwanese students' and teachers' surveys.
2. Analysis of Taiwanese students' and teachers' surveys, modification of theory, and design of the next data collection.
3. Second data collection, including:
   A. literature review of global education and the British Columbia curriculum and,
   B. observation of British Columbia classrooms.
4. Modification of theory.
5. Third data collection, including:
   A. British Columbia teachers interviewed and Taiwanese teachers surveyed and,
   B. both British Columbia and Taiwanese teachers' telephone interviews.
6. Analysis of the new data.
7. Refinement of theory.

Before embarking on this study, my theory of global education in Taiwan was a reflection of the assumptions of the curriculum, i.e. that if children learn

certain content about global environmental problems, they will assume responsibility to act to mitigate the problems. The development of theory is described in greater detail in Chapter four. The following is a brief summary of the process. I was concerned about the lack of evidence that children were changing their behavior after studying the prescribed grade six curriculum on global environmental problems. Thinking that perhaps there were statistical differences in the teaching of this material in different schools, I sent student and teacher questionnaires to three schools, one urban, one rural, and one urban school which specializes in environmental education.

When I analyzed the results I realized that my questions had not precisely probed the issue that concerned me -- what are the determinants of the learning outcomes of environmental education? Taiwanese students have environmental knowledge, but as their teachers responded, their knowledge is not enough to save the environment. There are some things needed to engage students in saving the environment. I then reviewed literature about global education from the Western perspective, and the British Columbia curriculum, and observed British Columbia classes in environmental education. The insights I gained led me to revise my theory that personal behavior change results from gaining knowledge of environmental problems. I realized major differences not only exist in the curricula between British Columbia and Taiwan but also in goals, assumptions and strategies used. The obstacles to implementing global education in the two cultures seemed to have some common aspects and some differences that needed to be explored.

In order to further refine my theory, I mailed a set of open-ended questions to ten Taiwanese and ten British Columbia teachers. I interviewed the British Columbia teachers and telephoned the Taiwanese teachers to clarify their responses. Finally, I formulated a theory to relate Taiwanese cultural determinants to the learning outcomes of global environmental education. Because the steps of sample selection and analysis are interwoven with the development of my theory, a chronological description and the details at each step are provided in the next chapter.

Analytic Procedures of Grounded Theory

Strauss & Corbin (1990) affirm that grounded theory is a scientific method, if its procedures are carefully designed and carried out (p. 27). In this study as mentioned in the previous sections, the data collected from various sources, such as interviews, observations and literature reviews (p. 20 & 52) were designed to build a well-constructed grounded theory. Moreover, the analytic procedures guiding the data collection were an important feature of grounded theory research (p. 181) as described below.

In grounded theory which is referred to as the constant comparative method of analysis (Strauss & Corbin, 1990, p. 62), a number of the analytic procedures occur at the same time: collecting information from the field, conceptualizing data into categories, making comparisons for similarities and differences between the contexts, asking questions about data, and using the conditional matrix to analyze data (pp. 62-63 & 166-168). In this study, while the data collected from the British

Columbia and Taiwanese teachers' surveys and the telephone interviews was analyzed and compared, data analysis unfolded over four phases: coding, diagraming, memoing and tracking the data (see Table 9).

The following is my summary of the four phases of data analysis based on Strauss & Corbin's (1990) grounded theory procedures:

Table 9. The Four Phases of Data Analysis

Phases	Procedures
1. Coding	• Make comparisons to identify and categorize concepts. • Place the codes into categories. • Make sure no important information has been overlooked.
2. Diagraming	• Make graphic representations of the relationships between concepts. • Make comparisons to identify how the categories are related to one another.
3. Memoing	• Write memos from the diagrams. • Date to remain orderly, progressive and systematic memos. • Include reference pertaining short quotes and the code number of the participants.
4. Tracking	• Locate action pertaining to a phenomenon at the center of the matrix. • Fill in the specific conditional features for each level at the outer part of the matrix. • Trace conditional paths to determine how the various conditional levels relate. • Systematically relate concepts to develop theory.

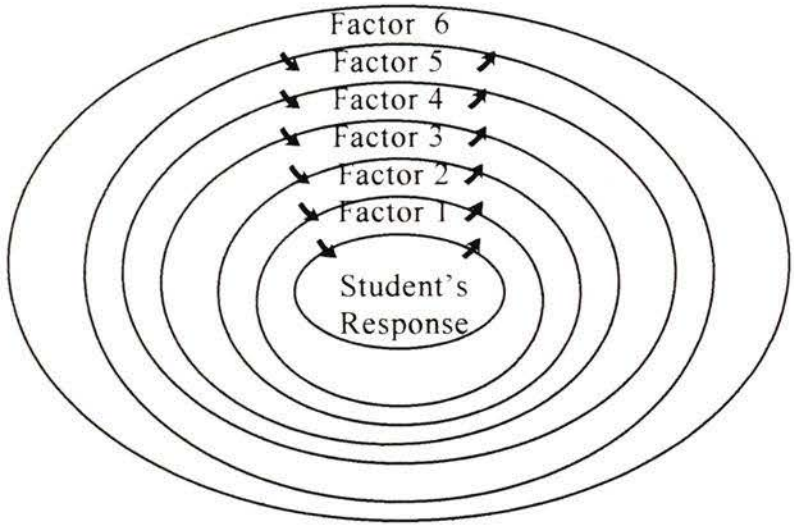
The initial phase of data analysis consists of coding the data and has two steps that occur simultaneously along with data collection. The first step of the coding phase is to read and reread the data to ensure the researcher knows the data inside out. In the second step the codes are analyzed into categories (Coffey & Atkinson, 1996).

Interview and mailed questionnaire summaries then are organized by the research questions and coded based on the categories. For example, the comparison between data collection of teaching time allotments of British Columbia teachers and Taiwanese teachers was a method of obtaining the range of time teachers allotted to teaching environmental education (Shaver, 1991; Gall, Borg, & Gall, 1996, p. 386), and determining which goals, obstacles and strategies are common to the teachers. This allows for common themes to emerge across the data and for variations to be identified in the third phase in this qualitative analysis. Specific quotes are highlighted for use in the findings portion of this study, and data analysis continues into the writing stage. Variations and patterns, such as the relationship between obstacles and the time teachers allotted to teaching environmental education, are also noted.

The final phase in this analysis is to track the data by using the conditional matrix (see Figure 3), which not only opens up the researcher's analysis to a wide range of possible conditions that bear upon a given phenomenon, but also enables the researcher to relate this phenomenon specifically to those conditions (p. 164). Strauss & Corbin (1990) stress that "The purpose of grounded theory methodology is to develop theory"(p. 167). They believe that "A formal theory...emerges from a study of a phenomenon examined under many different types of situations"(p.174). It is important for me in this study to examine a phenomenon embedded in different matrix levels. The details of analyzing students' and teachers' responses in both BC and Taiwan are described in Chapter 4.

Figure 3. Analyzing an Elementary School Student's Response through the Conditional Matrix:

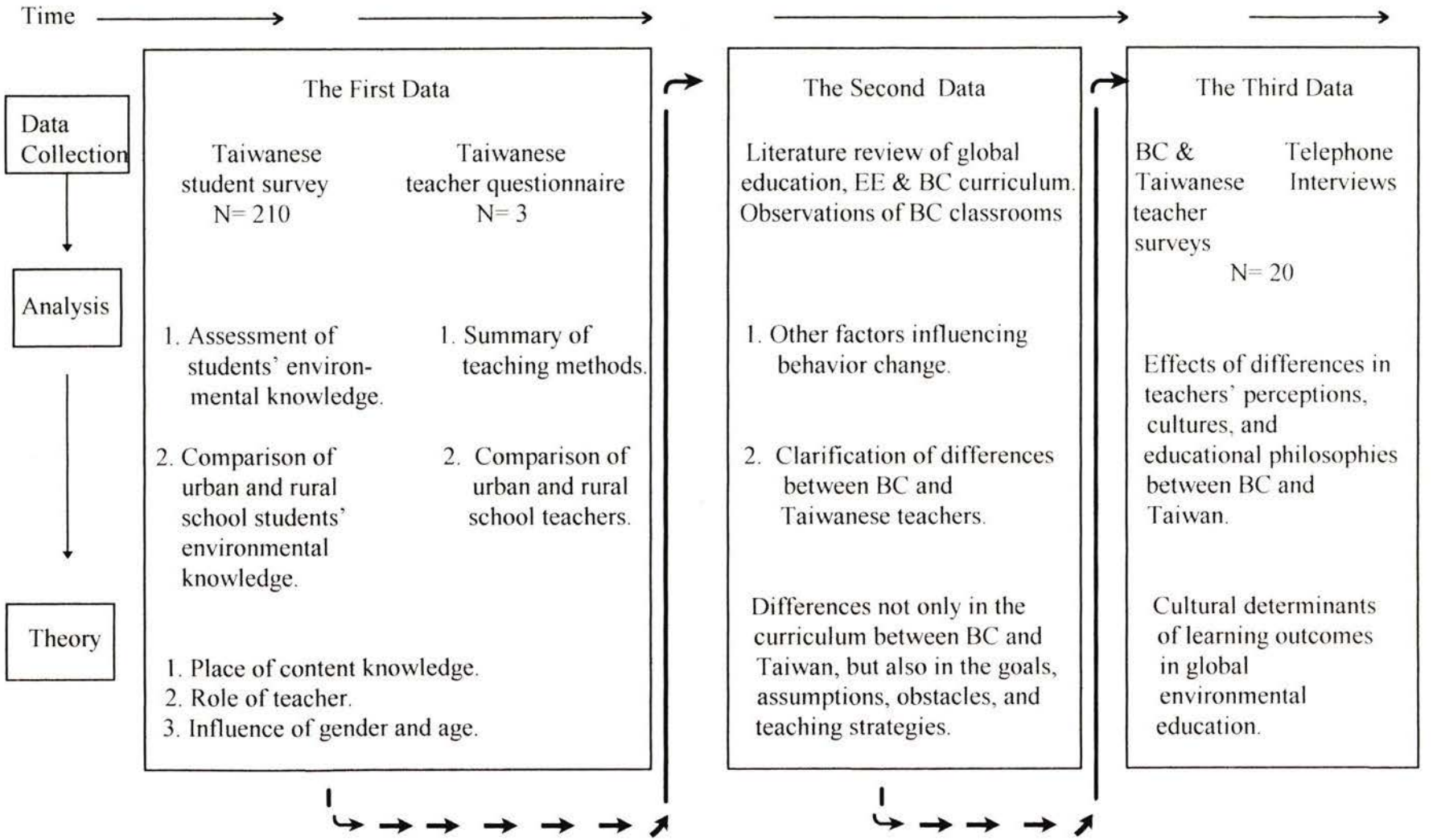
The student's response (paradigm shift) is influenced by factors in each of the concentric circles.



Note. 1. ↘ indicates that one factor influences the other factor.
2. It is necessary to apply a term to describe the change in a child from taking an idea, integrating it personally, and finally expressing it by actions in his/her daily life. I use the term "Paradigm Shift". For example, in the classroom students learn about the importance of the four Rs: recycle, reuse, refuse and reduce. When they willingly adopt these behaviors in their daily lives, they have experienced a paradigm shift.

Furthermore, data collection and data analysis are tightly interwoven processes. I used literature regarding culture and educational philosophy in British Columbia and Taiwan to supplement interviews, questionnaires, as well as my own observations in developing a grounded theory in this study. Then, I drew some conclusions and came up with a newly refined theory concerning the cultural determinants on the learning outcomes of global environmental education (see Figure 4).

Figure 4. Process in Grounded Theory Applied in this Study



Reliability

The extent to which findings can be replicated is known as reliability. In the traditional sense, the term reliability does not seem to apply to qualitative research. Yet Strauss & Corbin (1990) believe that given the same theoretical sensitivity of the original researcher and following the grounded theory procedures for data gathering and analysis, plus a similar set of conditions, another investigator should be able to come up with the same theoretical explanation about the given phenomenon (pp. 250-251).

Summary

The desired goal for this study is to formulate a grounded theory that presents the analysis of the determinants of learning outcomes in environmental education in Taiwan. Grounded theory methodology is used to constantly make comparisons of the implementation of environmental education between Taiwan and British Columbia in order to determine what might be needed in Taiwanese education to facilitate the process whereby students could assume a sense of personal responsibility for helping to solve global environmental problems.

In Chapter four, the findings of the study are described and analyzed. Chapter five summarizes what has been achieved in this study, and further develops the grounded theory. Chapter six, includes policy recommendations and further research needed to test the theory.

CHAPTER FOUR: RESULTS AND DISCUSSION

Introduction

This chapter is divided into three sections. The first section describes the findings from the Taiwanese students' and teachers' surveys. The findings lead to the modification of theory and design of the next data collection. The second section describes the researcher's observations and reflections on British Columbia and Taiwanese environmental education, and also the further modification of theory. The third section describes the findings from the British Columbia teachers interviewed and Taiwanese teachers surveyed; both British Columbia and Taiwanese teachers' telephone interviews; and further refinement of theory. The results from each section are discussed and summarized in this chapter.

The First Data from Taiwanese Students' and Teachers' Surveys

As mentioned in Chapter 3, the first data collection conducted in Taiwan during Spring, 1997, was surveys of Taiwanese students and teachers to develop a preliminary theory of learning outcomes of global environmental education from a comparison of three schools. With the permission of the principals (Appendix A), surveys were done at the selected grade six classes. After administering the students' questionnaire in their classrooms, the social studies teachers delivered the completed questionnaires to the principal; meanwhile, they received the teacher questionnaire (Appendix E) from their principals, and answered it. The principals mailed the completed student questionnaires to me. A few days later,

the teachers also mailed the completed teacher questionnaires to me. A total of two hundred and ten student questionnaires and three teacher questionnaires represented a one hundred percent response rate. The specific steps of the first data collection and analysis in chronological order are described below:

1. Sampling.
2. Taiwanese students surveyed.
3. Taiwanese teachers surveyed.

1. Sampling

The sampling consists of three groups: a rural school, and two urban schools including a environmental education school. These three selected schools are particularly likely to yield significant insights about the phenomenon of interest and also match well in terms of the demographic variables (e.g., gender distribution) of the student and teacher populations.

Located in a small town in which there were only sixteen thousand residents, the rural school selected for this study had been established for eighty-five years. Although eight hundred students and fifty teachers enjoyed the beautiful and quiet environment, a nuclear power plant involving hazardous wastes and potential problems was built near the school in the past decade. Next, one urban school was selected because in its setting air pollution was more serious than that of other neighborhoods. Finally, the other urban school chosen in the study shared a reputation in Taipei for its superior disciplinal ethos and environmental education which might distinguish the school from the other two schools. Each school selected two classes, making a total of six classes. Although

the schools are in different settings, the social studies teachers use the same textbooks to instruct their students.

2. Taiwanese Students Surveyed

In order to determine whether the average score of the test of urban elementary school students' global environmental knowledge is higher or lower than that of rural school students, I used a quantitative analysis (Shaver, 1991) of scores on a multiple-choice form of eleven items. The student questionnaire (Appendix D), testing students' global environmental knowledge, is based on the Taiwanese government tests for elementary, junior high and high school students (Environmental Protection Administration, 1997b). I translated them into English (see Table 10), and added a report of the demographic information at the top of the questionnaire (Appendix B). In order to ensure the student survey was a standardized test and had a relatively high ability to discriminate between better and poorer students, I divided it into three dimensions: acid rain, global warming and ozone depletion, and compared the content with the Taiwanese grade six social studies textbook and other references. A description and explanatory note of each item appears in Table 11. Five out of eleven items of the student questionnaire were similar to the content of the textbook which students had already learned in social studies classes before they filled the questionnaire out. However, they were not familiar with the rest of the items which were not mentioned in the text unless their teachers had additionally instructed them about

these items in the classroom. In the items of the questionnaire, students had to choose one out of four or six choices (with a chance of less than twenty five percent to guess the right answer), with a possibility to circle the scale of "*I don't know*" (no opinion).

Table 10. Taiwanese Grade Six Student Questionnaire: Global Environmental Knowledge

1. Acid rain has a PH of less than 5.6 a) true b) false c) I don't know.

2. What pollutants contribute to the greenhouse effect? a) carbon dioxide b) chlorofluorocarbons (CFCs) c) ozone d) nitrous oxide e) all answers f) I don't know.

3. If the greenhouse effect occurs, what would be the incorrect results? a) the North Pole would melt b) the world's oceans would rise c) the Earth's surface would rise d) the Earth would get warmer e) many cities and homes would flood f) the planet's forests would disappear g) many animals would become extinct. h) I don't know.

4. A Pollution Standards Index reading of 101 to 199 indicates air quality is: a) poor b) very poor c) harmful d) all answers e) I don't know.

5. What part of the environment is damaged when we use air conditioners and aerosol spray cans? a) forest resource b) land resource c) water resource d) the ozone layer e) all answers f) I don't know.

6. When fossil fuels burn, chemicals are released and mix with the air; causing: a) fog b) lightning c) acid rain d) hailstones e) all answers f) I don't know.

7. What part of the sun's rays damages the ecosystem? a) infrared light b) ultraviolet light c) laser rays d) all answers e) I don't know.

8. Which of the following act as "the lungs of cities"? a) factories b) automobiles c) environmentally protected parks d) all answers e) I don't know.

9. Where is the highest concentration of ozone reached? a) the Earth's surface b) outer space c) between 20 and 30 kilometers above the Earth's surface d) I don't know.

10. In order to avoid global warming, we could damage the atmosphere and let the heat escape to outer space. a) true b) false c) I don't know.

Note: The source of the student questionnaire is Environmental Protection Administration (1997b). *The Test of Environmental Protection Knowledge* (in Chinese). Available Internet: http://www.epa.gov.tw/Chinese/resource/airq.htm. Hui-Mei Tsai adopted and translated the eleven questions of them referring to the three global environmental topics in the *Taiwanese Grade Six Social Studies Textbook* (1995b).

Table 11. Details of the Taiwanese Grade Six Student Questionnaire

Student Survey Question Number	Content	Explanatory Note	Textbook Based	Not in Text
		Knowledge of Acid Rain		
1	Acid rain has a PH of less than 5.6	(Sterling, 1991, p. 43)		√
4	A Pollution Standards Index reading of 101 to 199 indicates air quality is a very poor level.	(Environmental Protection Administration, 1997)		√
6	When fossil fuels burn, chemicals are released and mix with the air; causing acid rain.	(Sterling, 1991, p. 5)	√	
11	Acid rain produced by some countries can affect other countries.	(Sterling, 1991, p. 12)	√	
		Knowledge of Global Warming		
2	Carbon dioxide, chlorofluorocarbons (CFCs), ozone, and nitrous oxide contribute to the greenhouse effect.	(Steger, 1990, p. 7)		√
3	If the greenhouse effect were to occur, the North Pole would melt; the world's oceans would rise; the Earth would get warmer; many cities and homes would flood; the planet's forests would disappear; many animals would become extinct.	(Steger, 1990, pp. 10-12)		√
8	Environmentally protected parks are also called "the lungs of cities."	(Environmental Protection Administration, 1997b)		√
10	We should not damage the atmosphere to avoid global warming.	(National Geographic Society, 1991)	√	
		Knowledge of Ozone Depletion		
5	When we use air conditioners and aerosol spray cans, the ozone layer is damaged.	(Steger, 1990, pp. 28-42)		√
7	Ultraviolet light damages the ecosystem.	(National Geographic Society, 1991)	√	
9	The highest concentration of ozone is reached at between 20 and 30 kilometers above the Earth's surface.	(Steger, 1990, p. 27)	√	

3. Taiwanese Teachers Surveyed

To identify whether there are obstacles inhibiting teachers in implementing global environmental education, I used a qualitative method to collect the data concerning the teachers. A questionnaire (see Appendix C) containing twenty-nine open-ended items was used to record this information in a narrative form (Preissle-Goetz & LeCompte, 1991). I also divided the teacher questionnaire, pertaining to the teachers' backgrounds, into three sections:

A. the teachers' instructional methods and textbook.
B. the teachers' preparation and evaluation.
C. the teachers' thoughts and feelings.

Many of the questions require the respondents to spend time in considering their answers on the instructions of global environmental education in each social studies class. To be answered accurately, these questions require the respondents to review the content of their courses before reporting their instructional methods and feelings in these particular classes.

At the outset of the teacher questionnaire, the teachers were told of the content of the student questionnaire, and were asked to identify the relationship between teachers' instructions and the content of textbooks. This procedure is essential to determine if the teachers' teaching is based on the content of textbooks as indicated in the results of the student questionnaire.

Analysis

Once the first data from the Taiwanese students' and teachers' surveys was collected, it was followed by analysis of responses and then design of the next investigation and data collection. The results and analysis are described below:

1. Taiwanese students' responses analyzed.
2. Taiwanese teachers' responses analyzed.

1. Taiwanese Students' Responses Analyzed

The three Taiwanese elementary schools were selected for comparison. A single tail *t* test was run to verify whether the three schools had statistically different results on the student survey. The test results indicate that the urban environmental education school test mean (7.021) is significantly higher ($T = 6.67$, $df = 105$, $p = 0.000$) than the rural school mean (4.875). The average score of the urban environmental education school is also higher ($T = 2.18$, $df = 100$, $p = 0.016$) than the urban school mean (6.404). The lower scoring schools are located in areas with more environmental problems.

2. Taiwanese Teachers' Responses Analyzed

Comparing the data collection from their teachers' questionnaires with the average score of the students, I found some interesting results. The students who got the highest average score in the test were taught by a twenty-five year old male teacher who had been a teacher for only three years, compared to the twenty-year teaching careers of the two female teachers (see Table 12).

Table 12. Comparison of the Results between the Taiwanese Teacher and Student Surveys: A Sample

Teacher Survey	Urban School	Urban EE School	Rural School
Gender	Female	Male	Female
Age	43	25	32
Years of teaching career	23	3	10
In the Unit:			
Using materials	Textbooks, teacher guide, charts, blackboard and chalk.	Textbooks, teacher guide, charts, blackboard and chalk, videos, slides, transparencies.	Textbooks.
Teaching time	16 hours	16 hours	18 hours
Homework Assignments	2 times	6-8 times	2 times
Student Evaluation	1 time	4 times	1 time
Teaching this unit	Important	Important	Important
Students' interest	So-so	Excellent	So-so
Student survey: Average score (Total marks: 11)	6.40	7.02	4.88

The male and youngest teacher taught in the urban environmental education school and precisely followed the *Teacher's Guide*, pinpointing the highlights of the textbook for his students' review of the unit, and fully used videos, transparencies, charts and slides to illustrate the unit during his teaching. He also assigned three times more student home work, and two times more tests than other teachers. Perhaps this explains why his students were interested in his instructions, and got the highest average score in the test.

Second, all of the teachers, even the rural school teacher, responded that urban school students were more sensitive to environmental issues, such as noise and air pollution than rural students were. Third, all of the teachers taught students the textbooks. Almost all of the students could answer correctly only the items that the textbook had indicated (see Table 13).

Table 13. Comparison of the Percentage of Correct Answers of the Taiwanese Grade Six Student Test between Urban and Rural Schools

		Percentage of Correct Answers					
		Urban School (N= 52)		Urban EE School (N=94)		Rural School (N= 64)	
Class Code		A	B	A	B	A	B
		N=30	N=22	N=47	N=47	N=32	N=32
Textbook material	#5	73%	86%	96%	87%	47%	53%
	#6	77%	82%	94%	96%	59%	75%
	#7	77%	86%	87%	96%	56%	84%
	#10	87%	95%	96%	87%	66%	84%
	#11	93%	91%	96%	89%	69%	78%
Material outside textbook	#1	10%	18%	26%	26%	34%	6%
	#2	33%	18%	11%	23%	31%	38%
	#3	40%	18%	51%	49%	9%	19%
	#4	17%	36%	11%	15%	16%	22%
	#8	53%	68%	77%	70%	31%	34%
	#9	47%	86%	55%	74%	34%	28%
Class average score		**6.07**	**6.86**	**6.96**	**7.09**	**4.53**	**5.22**
School average score		**6.40**		**7.02**		**4.88**	

This teaching and learning trend was so obvious that even though a nuclear power plant had been built near the rural school in the past decade, the school teachers and students did not regard this issue as an additional source of environmental materials. Utilizing this opportunity to illustrate what was happening in their own community, might have enriched the students' global environmental knowledge.

Fourth, all of the teachers responded that during teaching the unit, "Our Global Village", they encountered obstacles including insufficient teaching time and preparation for the lessons. Finally, all of the teachers strongly affirmed that learning the unit was very important for the elementary school students. Meanwhile, the results of the teacher and student questionnaires suggest that the responses were honest. The students failed to correctly answer some survey questions which were not addressed by their teachers or the textbook. Also, the teachers explained why they did not teach these items, which had not been indicated in the textbook. Nonetheless, some weakness of this data collection are that I was not able to administer the questionnaires personally, and the questionnaire also focused on only a few global environmental topics according the Taiwanese textbook.

Design of the Next Data Collection

After analyzing the Taiwanese students' and teachers' responses, I revised and elaborated on my theory because although teachers play a crucial role in implementing global environmental education, good knowledge is not enough for students to apply to global environmental education in their daily life. Also,

I wondered whether British Columbia teachers encountered the similar obstacles in implementing environmental education as the Taiwanese teachers did. Thus, I decided to review literature about the British Columbia curriculum, observe British Columbia classes, and collect data from British Columbia and Taiwanese urban school teachers (see Figure 4, p. 57).

In addition, I also reviewed the information gained and methods used during the first data collection. Other improvements or change in methods such as eliminating weak questions were noted before I undertook the second data collection. Four questions were found to be leading questions by participants. These were questions on teachers' perception of the obstacles of the implementation of global environmental education within the schools. Moreover, although the youngest and the only male teacher's class average score was the highest in the students' survey, I decided not to pursue teachers' gender and age variables in this study, but to focus on the obstacles the teachers encountered, and the cultural determinants of learning global environmental education. Furthermore, after I studied the written answers of the Taiwanese teachers, I decided to use an open-ended form to question the urban environmental education school teachers about their teaching methods, time allotment and obstacles.

Summary

In the preliminary research, data-analysis methods such as using the Taiwanese textbook, student survey and teacher questionnaire, are triangulated to investigate the relation of the teachers' instructions and students' understanding of

global environmental knowledge. The qualitative information from the teacher questionnaire is useful in understanding that the Taiwanese elementary school teachers regarded teaching the unit, "Our Global Village" as a significant implementation of environmental education, however, there were also obstacles inhibiting teachers from instructing global environmental education. In addition, one participant from an environmental education school, was more likely deliberate and devoted to the instruction of environmental education than the other participants. Likewise, the responses also confirm that teacher differences play a considerable role influencing the implementation of global environmental education.

As Strauss & Corbin (1990) assert, any grounded theory study "is an action oriented model"(p. 122). Following receipt and analysis of the Taiwanese students' and teachers' responses, I had a concern that more factors, not previously identified, might contribute to learning outcomes. Thus, I sought more data from British Columbia and Taiwanese teachers in order to collect information about their experiences and methods of implementing global environmental education.

The Second Data from Literature

Strauss & Corbin (1990) indicate that literature can be used in grounded theory research as secondary sources of data, and supplementary validation. It can also stimulate theoretical sensitivity and direct theoretical sampling (p. 50-52). After analyzing the Taiwanese students' and teachers' surveys, I looked for more

background information from reviewing literature. It allowed me time to study British Columbia teachers' situation and teaching contexts, and develop a greater understanding of British Columbia teachers' teaching methods and environment prior to the person-to-person interviews. The literature reviewed has been described in Chapter 2.

Analysis

Let me now review and compare British Columbia and Taiwanese grade six social studies curriculum. Upon a closer analysis, both British Columbia and Taiwanese grade six social studies curriculum guides include environmental education.

In Taiwan, the mandated social studies program for developing a global environmental perspective exists in the *Taiwanese Grade Six Social Studies Textbook* and *Teacher's Guide* (Taiwanese Ministry of Education, 1995b& 1995a). It contains a unit called "Our Global Village" planned to equip the young citizen to deal thoughtfully and intelligently with global environmental problems. Encountering severe environmental problems and a deteriorating quality of life in the past three decades (Environmental Protection Administration, 1988), the Taiwanese government and public have become increasingly aware of environmental problems and initiated an effort in the social studies curriculum to develop students' global perspective (Environmental Protection Administration, 1992).

However, Taiwanese objectives of environmental education are different from UNESCO' s. According to UNESCO (1978) in the Tbilisi Declaration,

adopted from the world' first Intergovernmental Conference on Environmental Education, the categories of environmental education objectives are the following:

Awareness: to help social groups and individuals acquire an awareness and sensitivity to the total environmental and its allied problems.

Knowledge: to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

Attitudes: to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

Skills: to help social groups and individuals acquire the skills for identifying and solving environmental problems.

Participation: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

In addition, UNESCO (1993) advocates that educators should "set their sights on the attainment of the goals of environmental education i.e. awareness, attitudes, skills, motivation, commitment and ethical responsibility" (p. 4). Comparing the objectives of environmental education among UNESCO, British Columbia and Taiwan (see Table 14), it is obvious that Taiwanese intended learning outcomes don't emphasize providing students with an opportunity to be actively involved in working toward resolution of environmental problems as British Columbia learning outcomes do. Moreover, according to the BC Ministry of Education (1995), direct experience and responsible action are the two essential

environmental concepts that teachers need to take into consideration in their classes.

Likewise, comparing the teaching strategies, learning resources and evaluation methods of the grade six social studies curriculum between British Columbia and Taiwan (see Table 15 & 16), unlike British Columbia teachers, Taiwanese teachers' teaching time is limited, and teaching strategies are strictly limited to direct teaching of the textbook in the classroom. Not only do the teaching materials and students' discussion topics and evaluation refer to the textbook, but there are neither additional print materials to be used nor activity projects to be carried out. Thus, time allotted by Taiwanese teachers could be restricted by external factors; as well, Taiwanese teachers might be forced to be resourceful in implementing environmental education.

In contrast, the emphasis of the British Columbia objectives on environmental education, which focuses on helping students to actually solve environmental problems, is in line with the recommendations for environmental education objectives contained in the Tbilisi Declaration (UNESCO, 1978). Furthermore, British Columbia teachers are able to use more resources and various evaluation methods than Taiwanese teachers could. Also, BC teachers might tend to regard hands-on activities and projects as being of substantial effectiveness in the implementing of environmental education. A more detailed discussion of the BC Ministry of Education document "*Environmental Concepts in the Classroom*" (1995) is discussed in Chapter 4, pp. 128-140.

Table 14. Comparison of Objectives of Environmental Education from UNESCO, British Columbia and Taiwan

UNESCO	British Columbia	Taiwan
• Awareness	Generate ideas related to environmental concerns that show awareness of different view points(p. 61).	Show awareness of the environmental issues, and problems that the global village faces (p.66).
• Knowledge	Learn how Canadians use and manage natural resources and make comparisons of management and conservation practices in other countries (p.63).	Know the influences of environmental problems in the global village (p. 66).
• Attitudes	Support a position on a national issue by considering competing reasons from various perspectives (p.54).	Show willingness to take actions in solving the problems of the global village(p.66).
• Skills	Demonstrate an ability to research information using current technology (p. 54).	Demonstrate an understanding of the solutions to global environmental problems (p. 66).
• Participation (i.e. motivation, commitment, ethical responsibility)	Design, implement, and assess detailed courses of action to address national problems or issues (p.54).	None.

Sources: 1. UNESCO. (1993). Teaching global change through environmental education. *Connect*, XVIII (1), p. 4. New York: UNESCO.
2. B.C. Ministry of Education (1996b). *Social Studies K To 7 Integrated Resource Package* (Draft). Victoria: Ministry of Education, Curriculum Branch.
3. Taiwanese Ministry of Education. (1995a). *Grade Six Social Studies Teacher's Guide* (in Chinese). Taipei: Taiwanese Ministry of Education.

Note: The sources focus on both British Columbia and Taiwanese social studies curricula. The B. C. Ministry of Education document "*Environmental Concepts in the Classroom*" is discussed in Chapter 4, pp. 128-140.

Table 15. Comparison of Teaching Strategies of Grade Six Social Studies Curriculum in BC and Taiwan: A Sample

British Columbia	Taiwan
• Provide students with aerial and satellite photos and have them locate topographic features and urban settlements. (p. 62)	• Have students observe a satellite photo in the textbook, and ask students: What would you feel if you could see Earth from outer space? And why? (p. 68) 5 min.
• Have students work in groups to examine relationships between urban settlement patterns and proximity to bodies of water.(p.62)	• Have students read textbook and ask students what " global village" means. (p. 69) 15 min.
• Introduce the concept of the ecological footprint. Have students compare consumption patterns in different countries. (p. 62)	• Present information on global environmental problems. (p. 76) 20 min.
• Have students analyse a BC river in terms of conservation and resource management. (p. 54)	• Ask students to draw a histogram of the world population and answer the questions in the textbook.(p. 71) 25 min.
• Challenge students to use four different technologies to research information on a specific topic or question. (p. 54)	• Provide students with an enlarged Taiwanese map and ask students to stand on the map. Ask students to record their feelings when others push them (p.71).
• Simulate a historical or controversial event and have students record their observations and interpretations. Provide opportunities for them to share their observations in small groups and to discuss why they have different perspectives. (p. 54)	• Ask students to role-play someone whose motorcycle exhaust is black, and prepare an oral presentation explaining how to convince that person to stop polluting the air. (p. 84) 20 min.
• Challenge students to select topics for debate, such as "jobs are more important than forests" (p. 62).	• Referring to the textbook, ask students to discuss how to solve global environmental problems. (p. 87) 25 min.
• Ask students to design strategies to persuade Canadians to take a particular course of action. Then invite them to determine the feasibility of the strategies, select one, and implement it. (p. 54)	• Ask students to complete the list in the textbook about the solutions to global village problems that they are willing to address.(p. 87) 25 min.

Sources: 1. B. C. Ministry of Education (1996b). *Social Studies K To 7 Integrated Resource Package*. Victoria: Ministry of Education, Curriculum Branch.
2. Taiwanese Ministry of Education. (1995b). *Taiwanese Grade Six Social Studies Teacher's Guide* (in Chinese). Taipei: Taiwanese Ministry of Education.

Table 16. Comparison of Learning Resources and Evaluation Methods of the Grade Six Social Studies Curriculum in British Columbia and Taiwan: A Sample

Categories	British Columbia	Taiwan
Learning Resources	• Print materials, including twenty one books. (p. 63) • Videos (p. 63) • Games/ Manipulatives (p. 55)	• Print materials, including three books. (p. 67)
Evaluation Methods	• To assess students' debating skills. (p. 63) • After students have presented reports on river-use issues, look for evidence that they defended their positions using supportive information. (p. 55) • Have students research an environmental issue by writing to two sources that would provide information from different perspectives. Ask students to compare and contrast the information they receive. (p. 63) • Work with students to develop a list of topics to be included in their research. After completing the study, use a jigsaw approach for further discussion. (p. 63)	• Written exams.(p. 163) • Oral exams. (p. 163)

Sources: 1. B.C. Ministry of Education (1996). *Social Studies K To 7 Integrated Resource Package*. Victoria: Ministry of Education, Curriculum Branch.
2. Taiwanese Ministry of Education. (1995b). *Grade Six Social Studies Teacher's Guide* (in Chinese). Taipei: Taiwanese Ministry of Education.

Summary

Overall, the differences of curriculum between British Columbia and Taiwan might be revealed in the implementation of environmental education. Although Orr (1993) states that all education is environmental education (p. 9), there are differences specific to environmental education for both British Columbia and Taiwan. The additional literature reviewed led me to pose a question: What are the determinants of the learning outcomes of environmental education? This question engaged my interest and stimulated me to observe British Columbia classrooms in order to find validation of the accuracy of my findings. Let me now provide my observations and reflections.

The Second Data from Observations and Reflections

Prior to the surveys of British Columbia and Taiwanese teachers' teaching experiences of environmental education, I visited several British Columbia elementary schools in Victoria. In addition to observing the schools' spaces, settings and students' activities in classes, I also made comparisons described as below about the implementation of environmental education between British Columbia and Taiwan:

1. The designs of both BC and Taiwanese elementary schools.
2. The role of the school in implementing environmental education.
3. The teaching strategies.

1. The Designs of both British Columbia and Taiwanese Elementary Schools

I was first interested in the designs of British Columbia elementary schools. Though the designs of British Columbia elementary schools are varied (see Figure 5), most are more closely built on the factory metaphor. Some new British Columbia schools would be considered similar to a resort by Taiwanese. This different point of view is likely linked to the differences in cultures. In Taiwanese culture, buildings symbolize authority (see Figure 6). It is thought that schools should differ from resorts so that students can concentrate on their academic performance and fulfill their parents' expectations. Meanwhile, Taiwan is the world's second densely populated country ("World Book", 1997, pp. 410-414) where many high-rise buildings have been erected. Thus, almost all of the Taiwanese elementary schools have four or five floors which are even more typical of the old factory metaphor.

British Columbia classrooms have more plentiful resources than Taiwanese classrooms have, such as microscopes, reference materials and globes (see Figure 7). I was surprised to see expensive equipment, such as two computers in the hall (see Figure 8) where they were accessible to students. In contrast, Taiwanese elementary school classrooms support an exclusive setting in which "formal learning" occurs.

Figure 5. The Designs of British Columbia Elementary Schools

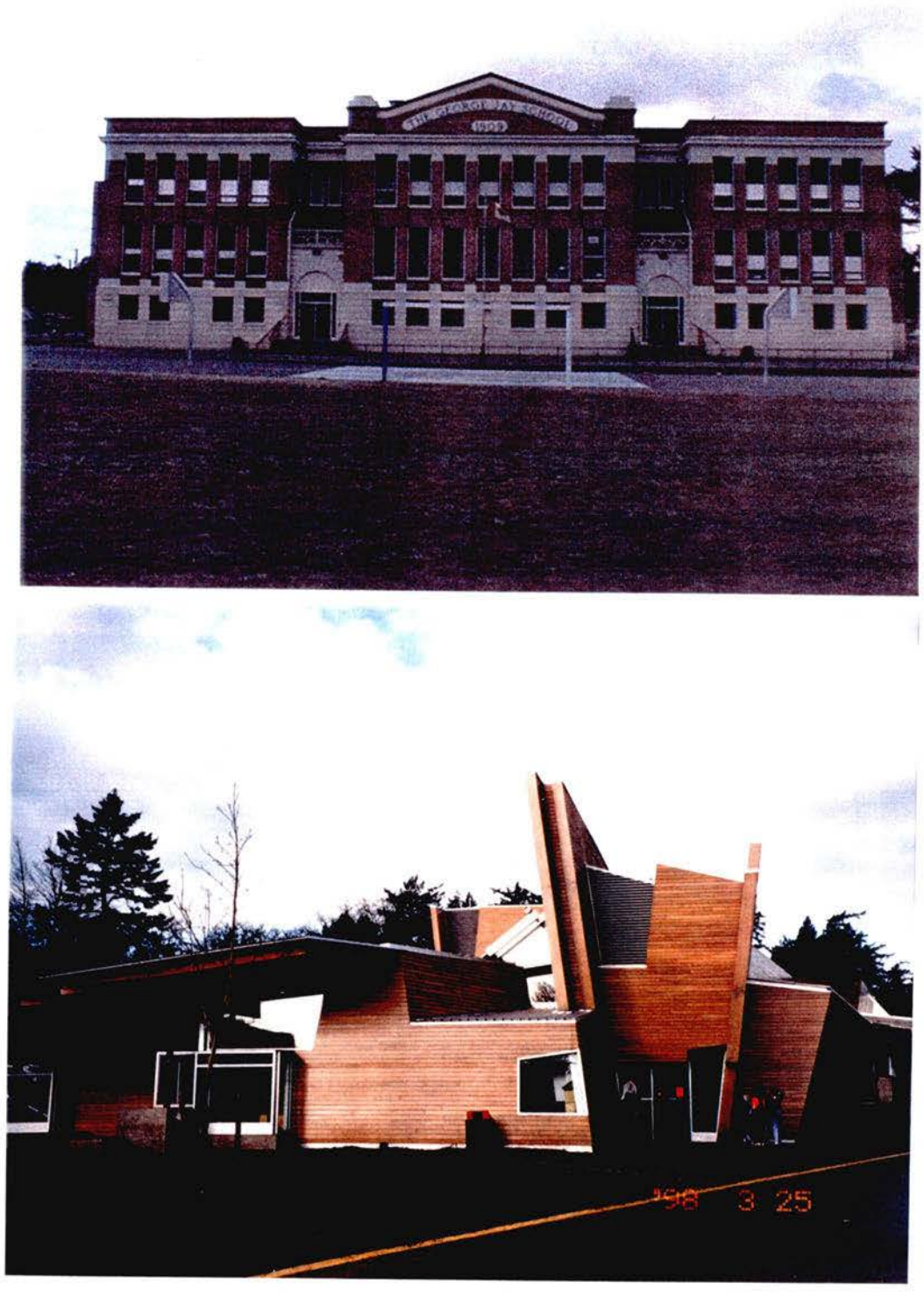


Figure 6. A Front Wall of a Taiwanese Elementary School

Figure 7. A British Columbia Elementary School Classroom

Figure 8. A British Columbia School Hall

I noticed that there were few plants marked with signs on British Columbia elementary school grounds. Conversely, in Taiwanese elementary schools the plants growing on the campus are usually marked with signs to convey their identification such as their names and habits (see Figure 9). It is a direct and practical kind of environmental education. Furthermore, in the Taiwanese elementary school classroom a corner is designed to contain cleaning equipment that students use on campus daily (see Figure 10). Also, students dry mops in the hall of their school (see Figure 11).

Figure 9. Identification Signs on the Taiwanese Plants on Campus

Figure 10. A Corner of a Taiwanese Elementary School Classroom

A corner of a Taiwanese elementary school classroom
containing cleaning equipment that students use on campus daily.

Figure 11. A Hall of a Taiwanese School

The mops were dried in the hall of the Taiwanese school by students.

2. The Role of the School in Implementing Environmental Education

For the past decade, the Taiwanese Ministry of Education has carried out a policy of annual awards to ten schools selected from K-12 schools, where the implementation of environmental education is outstanding. The criteria of the official approval include keeping the school clean (see Figure 12) and green, recycling (see Figure 13), adopting local parks, and helping communities with cleaning. Obviously, in addition to recycling, the emphasis is on cleaning. Even the adopting of local parks is for the purpose of keeping them clean. Consequently, Taiwanese teachers expand teaching environmental education into students' daily out of class time as a discipline. The relationship of the students to the environment must be seen within a context where obedience is highly valued.

Figure 12. Taiwanese Elementary School Students Daily Cleaning-up on Campus

Figure 13. Taiwanese Elementary Students' Recycling

In the right corner of the picture, there is a three-floor school building decorated by well-arranged plant boxes, cared for by students. Behind the truck there are many seven-floor apartments surrounding the school.

For example, students who pluck flowers or catch frogs on campus are punished by teachers. The cultivated environment is valued almost as a school property is valued. Historically in Taiwan, authorized discipline is a method of teaching environmental education in order to foster students' responsibility and appropriate behavior in their daily life.

In contrast, British Columbia schools have janitors to keep their schools clean. Every morning, students come to a spotlessly clean school with the messes of previous days just a memory. British Columbia students do clean-up projects of highway ditches or beaches not usually their schools. Moreover, there is also a policy of awarding "Environmental Green Schools" -- schools which focus on various projects, such as sharing information with others about the environment, improving conditions for animals and plants, and finding additional uses of materials that would otherwise be waste (Green Schools, 1998). It includes not only recycling and cleaning-up projects as Taiwanese schools do, but also includes reusing wastes, planting trees, and even writing individual letters to Ministers and associations to ask them to save trees. I was impressed by the green school banner and the global flag (see Figure 14) placed in the front foyer of the school . It seemed to advocate that a comprehensive environmental education could be a key to develop a global perspective. I also observed that the opportunity British Columbia elementary school students had to plant trees was an exciting activity in their schooling (see Figure 15 & 16). British Columbia schools in implementing environmental education seem to emphasize more love of the natural world than Taiwanese schools do.

Figure 14. A Green School Banner and a Global Flag placed in the Front Foyer of a British Columbia School

Figure 15. A Poster of British Columbia Students' EE Displays

Figure 16.
A Poster of
BC Students
Planting Trees

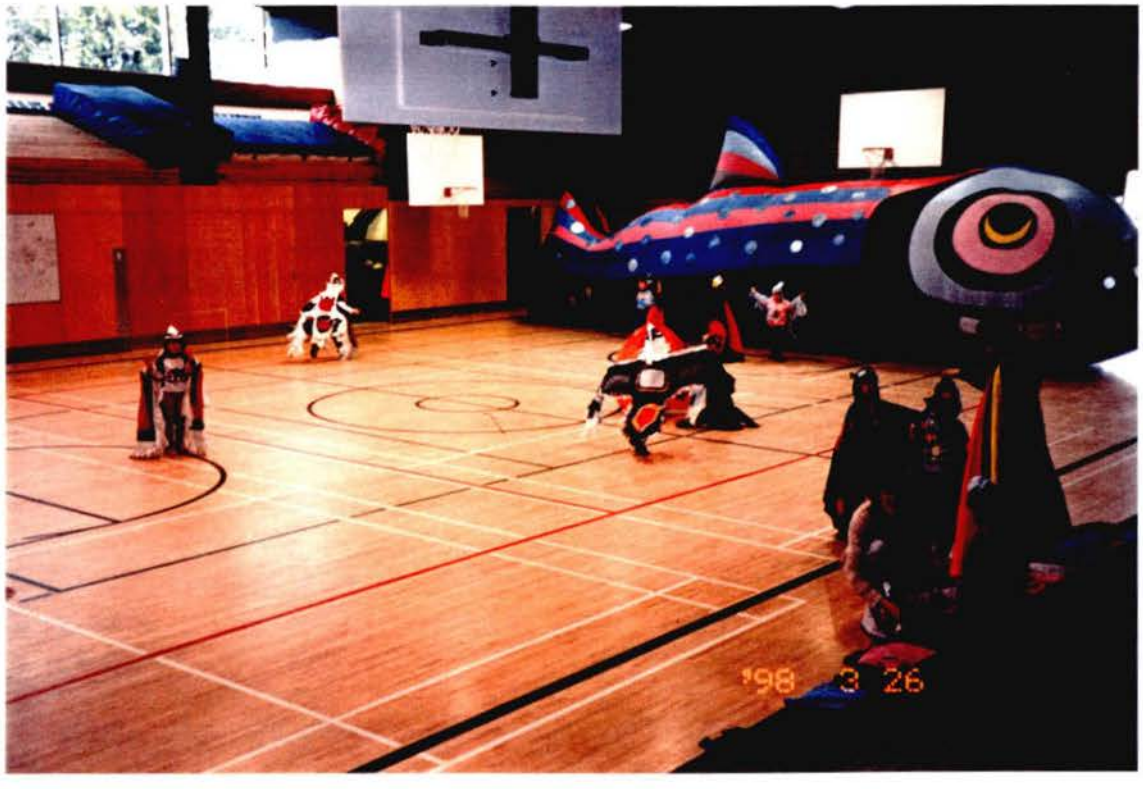
3. The Teaching Strategies

According to UNESCO, teaching aids involving games and simulation can be suitable teaching materials of environmental education to stimulate greater pupil participation (1982) because of their flexibility, varieties of possible content and practicality of application. "It exposes the many factors implicated -- natural, social, economic, etc. -- as well as the values" (1983). In addition, "students can make mistakes and learn from them, and perhaps later apply what they have learned in similar or relevant environmental situations in the world of reality" (1985a, p. 2). In observing British Columbia elementary school classrooms, I found that the students' activities including drama and games, were more diversified than that of Taiwanese students'.

Drama

In order to encourage students' awareness of the salmon conservation issue, British Columbia teachers decorated the gym with a big salmon balloon, dressed their students up as eagles, and instructed them to perform drama (see Figure 17). Without any audience students happily enjoyed the class time by learning how to appreciate the natural environment. This is further evidence that teachers play a crucial role in implementing environmental education. In the Taiwanese culture, I believe those lessons of drama would be a spectacular "show" at a conference on environmental education, played by selected students who spent at least one month rehearsing in order to perform for a number of teachers delegated from each elementary school.

Figure 17. British Columbia Students Dramatizing about Wildlife



Generally, the value of drama/role play in the curriculum for pupils may be as the following points:

- Providing a meaningful context to pupils in which to integrate knowledge, concepts and skills.
- Deepening understanding and awareness of attitudes and issues, and insight into why people think and behave as they do. (Peter, 1994)
- Giving students an opportunity to make decisions, and to solve a problem by presenting them with a situation that the students must deal with (Warren, 1992).
- Raising self-esteem through fun and satisfaction from the drama form (Peter, 1994).

Drama/ Role play, a teaching method as well as a means for personal and social development, is particularly suited to facilitating environmental education. Snively (1989a) states that using a case-study approach can help students "build a solid foundation of important content, problem-solving abilities, and defensible attitudes"(p. 99). For example, a fisheries-resource conflict among an old oyster farmer attempting to pass his business down to his son, a sawmill neighbor increasing the problems of water pollution, and a shellfish researcher developing an expensive artificial purification plant, can be conducted as "a skit, a debate, an interview, a puppet show, or as a felt-board story"(p. 100) in order to help students explore problems, associate different viewpoints, and brainstorm tentative solutions. However, Snively (1989a) also warns that case studies usually do not

focus on dull, everyday, mundane events. They require collecting relevant materials for in-depth analysis.

Comparing the teaching strategies between British Columbia and Taiwan, as mentioned in the prior section, it is obvious that the approach and processes used in British Columbia and Taiwan are different. Taiwanese teachers ask students to role-play someone whose motorcycle exhaust is black, and prepare an oral presentation explaining how to convince that person to stop polluting the air; while British Columbia teachers simulate a historical or controversial event and have students record their observations and interpretations. Taiwanese teaching strategies seem to avoid controversial issues. As providers of the correct answer, Taiwanese teachers are expected to explain the selected materials. The issue of "the correct answer" is important for students to work and learn, with no room for uncertainty or for trial and error (Brick, 1991). By contrast, British Columbia teachers might spend more than twenty minutes that Taiwanese teachers do, teaching controversial issues, enriching students' knowledge and empathy for the various component viewpoints, and developing students' abilities for critical thinking and decision making. This finding from observing British Columbia students' role-playing, is considered as an implication of cultural determinants of learning outcomes described in the next chapter.

Play Games

Playing, one of the most powerful ways for a child to learn, is the art of childhood (Koste, 1995). Particularly "in games, children learn to play with more

than one other child, choosing appropriate movements, speed, directions, and they can make decisions about relative merits of position and character of other players" (Lenel, 1969). Not only does Piaget's postulate that concepts arise out of the child's earliest experiences, support students' playing games to be related effectively to learning outcomes—the productive combination of student, content and process, but Lingelbach (1986) also believes that children learn best when they are actively engaged in using their senses to respond to a variety of stimuli.

After I observed that British Columbia elementary school students vigorously learned the environmental concepts in playing games (see Figure 18), I realized that creating and using learning games could be an effective teaching strategy of implementing environmental education. Not only does it facilitate students' motivation, proprioception and reinforcement, which are highly compatible with students' learning, but it also provides students with first-hand information about the physics of the surrounding environment. Many games provided by *Project Wild Activity Guide* (Canadian Wildlife Federation, 1995), are very interesting and meaningful, and also wisely used in British Columbia schools.

In contrast, the *Grade Six Social Studies Teacher's Guide* (Taiwanese Ministry of Education, 1995a) introduces a game for students to experience that a rapidly growing population deteriorates the Taiwanese people' quality of life. However, the game is limited within a few minutes in classrooms, and also involves a few students. This finding is discussed in the next chapter.

Figure 18. British Columbia Students Playing a Game about Baby Salmon

Outdoor Environmental Activities

As mentioned above, the Taiwanese students' activities such as playing games and role-playing are likely cultivated only in classrooms. Collecting information about outdoor environmental activities from both British Columbia and Taiwan, I found that Taiwanese elementary school students' out of school activities were arranged to many amusement parks or some artificial parks (see Figure 19) where very little natural education could be implemented.

Figure 19. Taiwanese Children in an Artificial Park

Likewise, during Earth Week in Taipei in 1998, there were apparently no activities related to environmental education in schools, or reported by newspapers. Rather, an unusual event of planting trees was carried out by the government and other organizers on Mother's Day to value the environment. This event may have been more for political than environmental reasons, but provided a good example to the community (Appendix Q, "The little trees," 1998).

By contrast, British Columbia school students not only do research in their field trips (see Figure 20 & 21) and do hands-on activities in their classes (see Figure 22), but also focus more environmental education around Earth Day. In the weeks leading up to Earth Week in British Columbia, not only did the local newspaper daily report more than one hundred Earth Week projects and activities around Victoria (McCullock, 1998) highlighting the need to conserve our planet's resources, but also as many as two hundred concerned citizens took part in Earth Walk '97 ("Parade for Earth Day", 1997). I was also impressed by one of the headings in a local newspaper:

> It's never too young to start caring about the planet. One-year-old Rowan Jones-Pardy looks out of the Great Bear Rain forest month as part of Earth Day activities ("Bear's-eye view", 1998, p. A3)

This news item is further evidence that British Columbia teachers regard community collaboration as an effective strategy. Such a community support around Earth Day is not yet developed in Taipei. Earth Day, a significant day known in Taiwan for a decade, gets people refocused, thinking about driving less, recycling more, building the compost bin or reusing plastic bags. However, teachers do not yet seem to be using it as a focus for environmental activities.

Figure 20. A Poster of British Columbia Students' Field Trips

Figure 21.

A British Columbia

Elementary School

Student Doing Research

Figure 22. A British Columbia Elementary School Teacher Teaching Students to Do Hands-on Activities at the Pond

Summary

After observing British Columbia classes in environmental education, and making comparisons between British Columbia and Taiwan, I realized that major differences exist not only in the curricula between British Columbia and Taiwan but also in goals, assumptions and strategies used. The obstacles to implementing environmental education in the two cultures seemed to have some common aspects and some differences that needed to be explored.

Strauss & Corbin (1990) indicate that the increasing sensitivity to concepts, their meanings, and relationships interweaves data selection with data analysis. "Each feeds into the other thereby increasing insight and recognition of the parameters of the evolving theory" (p. 43). My theory now must include cultural differences in goals, attitude and teaching strategies. I started to collect data from British Columbia and Taiwanese teachers as described below to look for teaching strategies, obstacles and goals that seemed previously not to have significance, but now might explain what is happening in implementing environmental education.

The Third Data from British Columbia and Taiwanese teachers' Surveys

As mentioned in Chapter 3, the third data collection in both British Columbia and Taiwan during Spring, 1998 was through an interview with each British Columbia participant based on the set of questions mailed in advance, and a self-administered set of mailed questionnaires to Taiwanese teachers. Two sets of questionnaires were sent out. The British Columbia teachers were interviewed

and the Taiwanese teachers were phoned in follow up. No names or identifying features were attached to written transcripts. A code key was developed that was located in a separate place from the data. As a result of my active contact with the participants, ten questionnaires and ten interviews were completed with a one hundred percent response rate. The following description provides the details about the process of the third data collection in the study:

1. Participants — Open-ended teacher questionnaires mailed to British Columbia and Taiwanese teachers.
2. Instrumentation.
3. British Columbia teachers interviewed.
4. Taiwanese teachers surveyed.
5. Telephone interviews — Further telephone calls to both sets of teachers were necessary to clarify points that arose during analysis of their responses.

1. Participants

Ten British Columbia teachers and ten Taiwanese teachers who participated in this study were recommended to me by the members of my supervisory committee and graduate students in the environmental education program, while the Taiwanese teachers were recommended to me by principals of Taiwanese schools in Taipei. These teachers were particularly likely to offer significant insights about environmental education at the grade six level. The participating teachers represent schools of differing sizes and differing personal levels of experience in teaching environmental education.

2. Instrumentation

After my observation and literature review in Victoria, I considered that because the curriculum and texts in BC differed completely from those in Taiwan. I could not use the earlier Taiwanese teacher questionnaire with the BC teachers. In the light of my observations and study of BC curriculum, I chose a qualitative research method of an open-ended questionnaire (Appendix L) and interviews.

British Columbia Teachers' Interview Questions

1. Approximately how much time do you allot to teaching environmental education in a year?

2. The draft IRP for grade six has at least three prescribed learning outcomes related to environmental concerns. These are highlighted on the excerpts attached. In teaching environmental issues to grade six, is your primary goal (or are your primary goals) to impart knowledge, to teach skills or to develop positive attitudes toward the environment? Please comment on why you emphasize the goal (goals) you have chosen.

3. What do you think influences the time teachers allot to study of the environment in grade six?

4. What obstacles or difficulties have you personally experienced in teaching grade six students environmental education?

5. What teaching strategies have you found to be most effective in teaching environmental education?

6. Other comments would be appreciated.

Taiwanese Teacher Questionnaire

The questions of the Taiwanese questionnaire are the same as those on the British Columbia teacher questionnaire except that they refer to the Taiwanese documents not the draft IRP (Appendix N, in Chinese).

3. British Columbia Teachers Interviewed

A package containing a cover letter (Appendix F), consent form (Appendix I), and interview questions (Appendix L & M) was mailed to the British Columbia participants as a prelude to conducting person-to-person interviews. The interview questions sent in advance allowed the teachers to prepare for the interview, and the interviewer to develop insights into how subjects interpreted their own words (Bogdan & Biklen, 1992, p. 96).

Interviews were audio-taped with the participants' permission and then were transcribed. The transcription was used to create an interview summary. Throughout the summary pseudonyms were used. Each participant was given a copy of both the transcript and the interview summary and was asked to clarify or expand as needed to be accurate.

4. Taiwanese Teachers Surveyed

Due to the fact that the participants of the study lived in different continents, this approach, using a mailed questionnaire and telephone follow-up was necessary. The researcher, who had lived in Taiwan for forty years, relied on

her familiarity with Taiwanese education, school systems, people and culture, but validated responses with telephone calls for clarification when necessary. The mailed questionnaire (Appendix N) was completed in Taiwan during Spring, 1998. A letter to participants (Appendix G, H, J & K), ensured that the teachers understood the purpose of the study, that they were participating voluntarily, that their participation had no effect upon their employment with the school district and that all information remained confidential.

5. Telephone Interviews

The data collection is designed to give rigor to the study that the researcher needs to maintain an attitude of skepticism, and periodically step back and question the reality of a phenomenon (Strauss & Corbin, 1990, pp. 44-45). After the data was transcribed, I studied the contents for emerging issues, themes and categories. I was puzzled, however, about some features of the data (p. 29). For example, the teaching time the British Columbia teachers offered me was vague. It is during this stage that I returned to the participants and interviewed them individually to insure the information gained from the previous interviews was clear, and to verify the new information. A hallmark of qualitative interviewing is learning about what is important in the minds of informants -- their meanings, perspectives and definitions, and how they view, categorize, and experience the phenomenon in the study (pp. 42-43). It was clarification of these points I sought. This part of the interview process took place using long-distance-telephone from

ten minutes to half an hour in conversations with teachers in Taiwan. The structure of the interviews was open and flexible.

Analysis of the Interviews and Surveys

The findings from the interviews and surveys are reported and organized around the research questions: 1) teaching time allotments; 2) goals of teaching environmental education; 3) influences in teaching time; 4) obstacles in teaching environmental education; and 5) the strategies the participants found most effective. Common themes which emerged for the questions are presented, and patterns, comparisons and variations within the data are noted.

1. Teaching Time Allotments

When the question was asked, " Approximately how much time do you allot to teaching environmental education in a year?", the responses from the participants were quite different (see Table 17). Most British Columbia teacher participants expressed that it was really difficult to answer this question since they were used to integrating many subjects in a period. They did, however, estimate an approximate time they allotted to teaching environmental education within a year.

By contrast, all Taiwanese social studies teachers are required to teach the entire textbook during precisely scheduled time which they could easily calculate. Interestingly, a variety of teaching time allotments appeared in individual responses despite the mandated time in the curriculum.

In the following analysis, I have identified each Canadian subject as C1 to C10, and each Taiwanese subject as T1 to T10. I approached the British Columbia subjects a second time in order to compare the different teaching time allotments. Despite my requests for clarification, British Columbia teacher participants still found difficulty in estimating the time allotted to environmental education. They commented that environmental education is integrated in most subjects and taught in many ways throughout the day:

(BC) I integrate a number of units for a total of about 6 weeks of class time. (C1)

> 1 to 2 x 45 min. science periods per week & most class field trips. All class periods and field trips are focused on environmental education. (C2)
>
> I tie environmental education to many subjects. e.g., a topic in science: Microscopic World. I tie environmental education, social studies, and language art into it. This is a big theme integrating many subjects. We were also doing the salmon incubator, raising baby salmon. Students helped to take care of the incubator. EE is taught throughout the year, indirectly. (C4)
>
> I taught an Environmental Study Unit. (C5)
>
> The environmental education topic would be integrated into social studies and science. Therefore, it is difficult to assess. (C6)

From our discussions, I assume that when these teachers speak of integrating environmental education in other subjects, the result is that approximately one to two hours per day would include environmental education in the period of weeks they described.

Table 17. Teaching Time Allotments in a Year

The following are the time allotments I have inferred from interviews and follow-up telephone calls to BC teachers and are based on approximations of times spent in integrated subjects. The teachers were reluctant to be this specific.

British Columbia Subjects	Time	Explanation
C1	About 30-60 hours.	
C2	About 40-50 hours.	
C3	About 100 hours.	
C4	About 50 hours.	
C5	About 30 hours.	Environmental Study Unit.
C6	About 10 hours .	
C7	About 20 hours.	
C8	About 20 hours.	
C9	About 80 hours.	
C10	About 60 hours.	

Taiwanese Subjects	Time	Explanation
T1	5 - 6 hours.	(About social studies 8 x 40 minute periods)
T2.	13 - 14 hours.	(social studies 20 x 40 minute periods per year)
T3.	7 - 8 hours.	(social studies 11-12 x 40 minute periods)
T4.	6 hours.	(About social studies 3 x 40 minute periods per week = 360 minutes)
T5	9 - 10 hours & 5-10 hours out of class time.	(social studies 14-15 x 40 minute periods)
T6.	9 hours.	(social studies 14 x 40 minute periods teaching the EE unit)
T7.	1 - 2 hours.	(About social studies 2 x 40 minute periods)
T8.	16 hours.	(About social studies 3 x 40 minute periods per week = 960 minutes)
T9.	9 hours.	(social studies 14 x 40 minute periods teaching the EE unit)
T10.	16 hours.	(About social studies 3 x 40 minute periods per week = 960 minutes)

Themes

1.1 British Columbia teacher participants allot more time to teaching environmental education in classrooms than Taiwanese teacher participants do

It appears that BC teacher participants spend from 10 to 100 hours per year teaching environmental education. All of the BC teacher participants tied environmental education to many subjects such as, social studies, science and language art. In contrast, the Taiwanese teacher participants did not tie environmental education to integration, and six out of ten of the Taiwanese teachers in classrooms taught environmental education less than ten hours in a year.

1.2 Taiwanese teachers' time allotments follow the curriculum regulations

It is worthy of note that several of the participants gave the following reasons for the time they allotted:

> Formally there are 68 class periods for the Grade Six Social Studies curriculum which includes 11-12 class periods about environmental education, nearly one sixth of the total class time. (T3)
>
> There is about 560 minutes in the unit of "Our Global Village", including 14 class periods for teaching environmental education. (T6)
>
> According to the demanded class time, there are at least two months required in teaching environmental education. (T8)
>
> According to the Grade Six Social Studies Curriculum regulation, there are 14 class periods required for teaching environmental education. (T9)

As one teacher stated, "This [teaching time allotment] is a curriculum regulation, it cannot be changed by teachers". The Taiwanese teachers indicated that the teaching of environmental education undertaken by the grade six teachers

focused on the unit of "Our Global Village" which allotted five hundred sixty minutes for the government's regulation rather than their personal preferences.

2. The Goals of Teaching Environmental Education

In the initial stages of the data collection process, the question posed to the participants regarding the goals they had chosen in teaching environmental education was in two parts: "What is your primary goal In teaching environmental issues to grade six?" and "Why do you emphasize the goal you have chosen?" Half of the participants found it difficult to choose only one goal of teaching environmental education.

However, they seemed to feel free to express their opinions in this study and they deliberately mentioned what they emphasized in implementing environmental education. Consequently, the data clearly show attitudes which are common to almost all of the participants as well as some differences within the British Columbia group. Although differences appeared in individual cultures, the emerged themes overlap in similar areas.

In analyzing the results of the interviews and survey, certain topics were repeated several times by different teachers. Participation was mentioned by five out of ten of the British Columbia teachers, but mentioned by only one out of ten of the Taiwanese teachers. Seven out of ten of the Taiwanese participants mentioned skills, while six out of ten of the British Columbia participants

described that skills were essential in the implementation of environmental education:

(BC) If you don't teach skills the students won't be interested in learning more. The skills are what the students enjoy the most. (C1)

Students can connect their learning with the world around them and engage in critical and cooperative dialogue. (C2)

[teach students to] look at different samples of water....[teach student] writing and reading - learning how pollution is created where it shows up. (C3)

...children have already taken care of bird feeders. The birds get some help. They have also already helped to build the trail, dedicate the park, and plant boulevard trees along the trail to preserve B. C.' s wildlife. (C4)

My primary goal is to teach the students problem solving techniques related to environmental concerns. (C5)

Teaching skills such as research, mapping and globe-work, we are extending the child's knowledge of the world around her [student]...teaching... skills as citizenship and developing interpersonal relations. (C9)

(Taiwan) ...educate students to have a clear and objective judgment is very important. They [students] should have the basic ability to judge the things in general. (T1)

Students should ...have the ability of solving these problems in order to protect our environment. (T2)

Have students gain...skills...in order to promote environmental education and establish a clear and concise foundation of environmental education in the future. (T3)

They [students] should learn how to use information and resources to deal with the environmental problems. Moreover, they should learn how to cooperate with other people. (T4)

Have ability of map-reading. ...when they [students] face a world map or terrestrial globe, it is quite hard for them to point out where specific continents and oceans are located. They have no concepts of countries and cities mentioned in newspapers and magazines. Thus, their studies are not related to the reality of their lives. That's why in my personal opinion, I strongly consider that developing students' ability of map-reading is the most essential goal of teaching environmental education. (T8)

The environment has a very close relationship with our daily lives that changes to the environment will have a great impact and serious influence on our lives.

> Therefore, it is necessary to ...teach them how to confront and cope with the environmental problems in order to protect our environment. (T9)
>
> ...nowadays the environmental issues are getting worse, it is more important than before for the grade six students to foster the good habit of protecting the environment, and practice that in their daily lives. (T10)

Themes

2.1 Grade six is a perfect time to develop a global environmental perspective

A noticeable feature of the interview and survey responses is that all of the participants in this study believe that environmental education is essential in their teaching especially at the grade six level in social studies classes:

(BC) Grade six is a perfect time to move to global awareness, because they study cultures of the world. Grade six is very suitable for developing a global perspective. (C4)

> Many students in this age group enjoy this topic because they realize that it is relevant to their lives and future. They have good collective knowledge and can help each other understand some of the issues. Children like learning about other children. When looking at global connections related to environmental problems, it's really important to understand/ include the culture, people component. e.g. How and why people live with the land related to their basic needs. Ministry of Environment provides good, usable, free resources to schools. (C5)

(Taiwan) We all are living in the global village. There is a very tight relationship bonding everyone. So, students need to understand this situation and have a global perspective. Students should be willing to solve the global problems and have the ability of solving these problems in order to protect the environment. (T2)

> The environment has a very close relationship with our daily lives and changes to the environment will have a great impact and serious influence on our lives. Therefore, it is necessary to let students know that point since they are young, and also teach them how to confront and cope with the environmental problems in order to protect our environment. (T9)

This finding supports the significance of this study and also supports the review in Chapter 2 that the elementary grades are beneficial to developing a global environmental perspective.

2.2 Developing positive attitudes is more important than other goals in both British Columbia and Taiwanese teachers' goals of teaching environmental education

Most of the participants agreed that developing positive attitudes was an important goal of teaching environmental education:

(BC) I would say that developing positive attitudes toward the environment is the goal that I emphasize the most. If everyone looked after the world it would be in fine shape. Unfortunately, this is not the case. My main goal is to make them environmentally responsible, global citizens. (C7)

(Taiwan) Nowadays Taiwan's serious problems are a lack of positive attitudes towards the environment, good behaviors and habits. Most people are used to having things convenient for themselves, and also only caring about themselves so that they tend to be selfish. That is, if they can get rich, they don't care about the deterioration of the environment. This degrades most people's quality of life. (T7)

It is worthy of note that the high degree of correlation between groups of subjects supports strong consensus. It suggests that the participants' opinions are almost the same in the major goals of teaching environmental education regardless of the sample size. However, a British Columbia teacher pinpointed:

> Developing positive attitudes is the goal of education, but is the most difficult to access and to teach. Students must really immerse themselves in their learning if they are going to develop positive attitudes towards the environment. They have to be involved in some type of action. (C1)

This significant finding raises another important theme, that of participation.

2.3 More British Columbia teachers than Taiwanese teachers emphasize active participation in environmental education

Only one out of ten Taiwanese participants wrote that active participation was important for students' learning environmental education while half of the British Columbia participants indicated that environmental activities were essential for helping students become involved in solving environmental problems and being aware of working toward these solutions in their daily life. This difference applies to other subjects but is more critical in environmental education.

> Through direct experience students can develop an "environmental ethic". Students can connect their learning with the world around them and engage in critical and cooperative dialogue. (C2)

> It is very important that we take action to do something to help the environment. When they [students] realize what they are learning, this leads to some worthwhile activities that are valued by the community, and they feel good about themselves. (C4)

3. The Influences on Teaching Time Allotted

Considering "What do you think influences the time teachers allot to study of the environment in grade six?", each of the participants listed many influences affecting the time teachers allotted to the study of the environment (see Table 18), and two major themes emerged.

Table 18. Influences on Teaching Time Allotted

	British Columbia Teachers											Taiwanese Teachers										
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Total	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Total
Increasing subject areas	X				X	X	X	X	X		6											0
Teachers' interest		X		X	X	X	X	X	X		7											0
Teachers' knowledge	X	X	X			X			X		5	X		X		X						3
Teachers' training	X	X	X	X							4											0
Teachers' skills	X			X	X						3			X								1
Teachers' requirements	X				X						2											0
Resources (Human resources e.g., Speakers & community resource people. Written & enrichment materials. Current events)	X	X	X				X		X	X	6					X			X	X		3
Funding (Field trips)	X										1											0
Class dynamics & size			X							X	2											0
School location			X								1											0
School feeling (Administrators' support)										X	1											0
Examinations											0	X		X	X		X		X	X	X	7
Textbooks											0	X	X	X	X	X		X	X		X	8
School activities (Campus athletics, school meetings & ceremonies)											0			X		X	X		X	X		5

In analyzing the results of the interviews and survey, certain topics were repeated several times by different teachers. I have listed these topics down the left side of Table 18. I have then indicated with an "X" which subjects mentioned these topics. Thus, we are able to compare the concerns of the British Columbia teachers with the concerns of the Taiwanese teachers. For example, examinations were mentioned by seven out of ten of the Taiwanese teachers, but not mentioned by any of the British Columbia teachers.

Themes

3.1 The teaching time allotted by British Columbia teachers is most influenced by personal factors

Most British Columbia teachers described that teachers' interest, knowledge, training, skills, requirements, and other factors such as increasing numbers of subjects and difficulty obtaining resources were the biggest issues influencing the time teachers allot to the study of the environment:

> Very little knowledge of what they need to teach. Teachers not familiar with IRP' s and what they really need to teach. (C1)

> The importance of resource, people help a teacher's interest, personal enthusiasm, professional development support. (C2)

> It depends on personal background, such as skills and interests. That's the big one. If teachers did not integrate environmental education, they would not have much time to teach it. Other influence is your passion or what you feel responsible for. (C4)

> Often teachers priorize their specific interests, skills, and requirements. (C5)

> A teacher's interest and knowledge would greatly influence the time given to environmental topic. (C6)
>
> Depends on how important the teacher sees it. (C7)
> I believe strong personal convictions and experiences may influence many teachers if you are someone who has deep concerns for Human Rights, then naturally you would regard environmental studies as having high priority. (C9)

This finding of British Columbia teachers as curricular-instructional gatekeepers in social studies coincides with the literature review in this study.

3.2 Taiwanese teachers' influences in teaching time restricted by external factors

Almost all of the Taiwanese participants complained that there were too many materials in the textbooks that needed to be taught and too many mandated tasks, such as school activities and examinations:

> There are many unified textbooks needed to be taught. Class time is also spent on many tests. (T1)
>
> Many factors such as too many teachers' meetings and school activities, usually occupy a lot of class time. (T3)
>
> Each class time has been fixed with a great deal of required teaching materials. (T4)
>
> There are many school activities, such as the preparation and practices of the campus athletics, benefit picnic, the founding anniversary of the school, graduation ceremony, and school meetings, as well as many activities out of school, such as conferences, even many holidays that reduce the class time available for in teaching environmental education. (T6)
>
> We need to teach the original materials in the textbooks first. If the time for teaching the unit of "Our Global Village" is impacted by holidays and school activities, such as athletics, vaccinations and meetings, it would be decreased so that teachers lack enough time to implement environmental education. (T8)

These problems seem to explain the prior finding that some teachers' teaching time of environmental education was less than that of the curriculum regulations.

3.3 Current events influence the teaching time

Many British Columbia and Taiwanese participants regard current events as an additional element of resources in implementing environmental education in classes:

(BC) As I understand, grade six students all know many countries, oceans and continents. When students ask teachers what El Nino is, teachers can take a globe out and ask students where the specific current events are or "where we are talking about ?". Once several eruptions of volcanoes occurred in the world within a week. That's a specific thing to teach for a moment. I would never stop teaching world geography because kids need to get knowledge. (C4)

In science for example I deal with Nigeria's shortage of fresh water by linking it to the study of bacteria and microscopes, etc. (C9)

Current issues [influence the teaching time]. (C10)

(Taiwan) The current events about environmental issues and the influences of media [influence the teaching time]. (T5)

News: If media have been constantly reporting about environmental issues, students would mention and discuss more in their daily and weekly journals and conversations. It would be a good opportunity for teachers to teach environmental education on the spur of the moment. (T8)

When some accidental current events happen this would facilitate teachers to add the lectures of environmental education in classes and teach students environmental education on the spur of the moment. (T9)

4. Obstacles in Teaching Environmental Education

When asked, "What obstacles or difficulties have you personally experienced in teaching grade six students environmental education?", the participants described many more obstacles (see Table 19) that they encountered in teaching environmental education than were described in the literature review in chapter 2. These various responses raise some themes which not only reveal the different cultural backgrounds between British Columbia and Taiwan, but also practical barriers to teaching environmental education.

Themes

4.1 Lack of teaching time is the major obstacle for both British Columbia and Taiwanese teachers

Seven out of ten of both British Columbia and Taiwanese participants reflected that lack of enough time in teaching environmental education was the most serious obstacle they encountered:

(BC) Time restraints. (C1)

Time constraints- tying existing curricula to the IRPs (social studies or science), time for planning field trips, etc. (C2)

(Taiwan) It is essential for teaching environmental education that students can experience the environment by themselves. Nevertheless, it is very difficult to have time to do so. (T4)

Teachers have too many teaching tasks (40 minutes x 30 class periods per week), so that it is difficult to prepare the materials well. (T5)

It is ideal for providing kids an opportunity to do research projects, but it would take students much time to do so. Since each class period only has 40 minutes, students could not have enough time to present their group projects. (T8)

Table 19. Obstacles in Teaching Environmental Education (Lack of ...)

	British Columbia Teachers											Taiwanese Teachers										
Obstacles	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Total	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Total
Time	X	X			X	X		X	X	X	7	X	X	X	X	X		X	X			7
Fitted topics						X					1							X				1
Resources (Written & enrichment materials e.g., equipment, videos, up-to-date information)	X	X			X				X		4	X	X	X		X	X	X	X		X	8
Communication network	X	X									2	X		X	X		X			X		5
Class dynamics & size	X				X						2											0
Building limitations					X						1											0
Field trips: (Too many district policies on field trips & Too many forms to fill out.)	X				X						2											
(Lack of suitable field trip sites)											0		X	X	X	X						4
(Funding)	X	X		X		X		X			5											0
(Students' security)											0				X							1
Long term projects	X										1											0
Weather condition	X										1											0
Students' concern (interest)							X			X	2	X								X	X	3
Controversial issues				X							1											0
Students' experiences (Unable to be aware of the environment & Lack of earlier experiences about the environment)											0	X	X				X			X	X	5

4.2 Lack of resources in teaching environmental education is a greater obstacle in Taiwan than in British Columbia

Eight out of ten Taiwanese participants indicated that lack of resources such as locations and information to demonstrate environmental education is a serious obstacle, while only four out of ten British Columbia participants expressed that lack of up-to-date materials was a barrier in their teaching environmental education:

(BC) Friendly resources [that] are updated and applicable to local areas are difficult to find. (C2)

A lack of up-to-date information. e.g. It is only in the last two years that books on Nigeria have been published for this age group. (C9)

(Taiwan) The teaching sources shortage. (T1)

Lack of up-to-date materials. (T2)

It is difficult to find a place as to demonstrate environmental education. (T3)

Teachers don't have enough information of environmental education, so that they need to have special training to require environmental knowledge, such as ozone layer, greenhouse effect and acid rain. It is also difficult for students to collect environmental information because there are a few environmental resources in the library and some of the resources are too complex and abstract for the elementary school students to read. (T6)

This finding is discussed in the next section with the researcher's observations and reflections.

4.3 Teachers play a crucial role in teaching environmental education

It is noticeable that two teachers from both British Columbia and Taiwanese participants indicated that they had not implemented environmental education in classes as well as they might have:

Question 1: Teaching Time	Question 4: Obstacles
(BC) 10 hours per year.	Lack of the topic fitting into the topics we study. It is easy to carry on with your regular units and not integrate environmental topics into these. I do not have a specific unit on environmental education. (C6)
(Taiwan) About 80 minutes.	There are no environmental materials in the textbooks. Usually teachers only teach what they gain from the textbooks so that unless the teachers are interested in the environmental issues, and also actively look for extra time and materials, there is no potential of implementing environmental education in classes. (T7)

Comparing these two teachers' responses with other teachers', it is evident that teachers' interests play a crucial role in implementing environmental education. The teacher who replied above that lack of the environmental education topic fitting into his teaching, admitted in his answer of the question 3: "A teacher's interest and knowledge would greatly influence the time given to environmental topic".

4.4 Lack of communication network to support Taiwanese teachers' implementing environmental education

The majority of the Taiwanese participants complained that parents' expectations and students' focus on their examination marks and school performance led to a general lack of regard for their communities and a specific lack of students' environmental experiences and interest in environmental education:

> Due to the high regard placed on exams and the study of the textbooks, it is hard for students and parents to have a common awareness of how environmental education is essential. Students lack of real life

> experiences. Relying on the textbooks, they cannot really understand the environmental issues. (T1)
>
> The government does not set a good example of how to protect our environment. This external environment does not support teachers to the implementation of environmental education. (T3)
>
> Since adults usually present incorrect examples, it is difficult for students to practice what they have learned from school in their daily lives. (T4)
>
> Although in past years schools have promoted environmental education, such as recycling, families and society cannot support and encourage children and so it is very difficult for children to practice environmental education in their lives. (T6)
>
> Parents fail to support teachers in their teaching of environmental education. The big environment (i.e., the whole society) fails to support school environmental education. Most people tend to be conservative so it is difficult to promote environmental education. For example, although children have already had instruction on protecting their environment, when they see other children or adults breaking the correct processes of protecting the environment, the children feel constrained about commenting because such comments would be disrespectful. Gradually, they also follow other incorrect examples. Thus, even though children have enough knowledge taught by their teachers, they cannot practice protecting their environment in reality... Environmental education should not be a concern of only the elementary school students. Even a tender seedling could quickly dry out in a deteriorating environment. (T9)
>
> Because of pressures from other subjects, students usually neglect or pay less attention to social studies. (T10)

This finding exposes that in Taiwan the communication network, including the public, communities, parents and students, does not work efficiently to support teachers' implementing of environmental education. Teachers regarded developing students' attitudes as an important goal of teaching environmental education, yet they were worried about the external environment such as the public and society negatively influencing students' attitudes toward the environment. This serious obstacle is likely to form an integral part of the reality, negatively effecting the teaching of environmental education in the long run. This finding is expanded in the next chapter.

4.5 Lack of funding is an issue for British Columbia teachers but not for Taiwanese teachers

Five British Columbia teachers mentioned that lack of funding somewhat inhibited them from teaching environmental education, while none of the Taiwanese participants replied about such an obstacle:

> Very expensive to take students to programs that are worthwhile. (C1)
>
> Equipment can be expensive. (C2)
>
> Field trips are good for environmental education, but fund raising is an issue. (C4)
>
> Lack of funds to purchase new equipment. (C8)

Ostensibly, lack of funding is an obstacle in implementing environmental education programs in British Columbia, not in Taiwan. However, there is evidence as in the previous finding that Taiwanese parents put high expectations on students' academic achievement. Thus, Taiwanese parents are used to willingly supporting their children' field trip fees of approximately $ 5 (Can.) so that Taiwanese teachers were not worried about funding as British Columbia teachers were, but the field trips were not designed for environmental study.

4.6 Fear of controversy in implementing environmental education

While it is true that only one out of all of the participants was concerned about controversy being a serious obstacle in teaching environmental education, it is worthy of note that fear of controversy is a significant hindrance for many teachers:

> The concerns I have, just be careful. Because when you are doing environmental studies, many controversial issues come up. Children like to take only one side, seeing in black and white, right and wrong. For example, I integrate forestry into the study of the environment. I have to make sure that I don't raise issues and concerns like "Should log or should not log?" Because I have some students in class whose families make a living in the forest industry. I don't want to alienate that group. I have many booklets and handouts from Greenpeace... They have their own educational goals, and they are trying to influence people. So, we have to watch out for bias and controversy. (C4)

This teacher is not alone in advocating why critical thinking should be considered in the classroom when controversial issues are being discussed. Clarke (1992) states in an article of *Green Teacher*:

> ...teaching controversial issues is a skill I was never taught even though trained as a social studies teacher... We are wary of controversy and we are concerned that our biases will taint our teaching"(Clarke, 1992, p. 11).

This finding is discussed in the next chapter, and is also considered as an implication of the study.

5. Effective Strategies in Teaching Environmental Education

When the question was posed, "What strategies have you found to be most effective in teaching environmental education?", every participant provided their experiences about how to efficiently teach environmental education. Although the responses varied (see Table 20), common themes emerged from the different cultural backgrounds.

Table 20. Effective Strategies in Teaching Environmental Education

Category	British Columbia Teachers											Taiwanese Teachers										
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Total	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Total
Outdoors (Field trips)	X	X	X	X	X	X			X	X	8	X			X	X	X				X	5
Activity projects (Work sheets. Classroom Incubation Program. Salmonid Enhancement Program. Work on solutions)	X	X	X		X	X		X	X	X	8					X						1
Teachers' training	X	X		X	X						4			X			X	X				3
Resource person (Speakers, Parent involvement)	X	X		X	X				X		5					X						1
Long- Term projects (Local park & beach programs)	X	X									2					X						1
Discussion groups	X				X		X		X		4			X	X	X			X		X	5
Displays (Role- playing. Posters for environmental information & Student reports. Debating. Celebrating Earth Day.)	X				X				X		3		X	X	X				X		X	5
Videos					X				X		2		X	X		X	X	X			X	6
Writing/ Reading								X			1			X					X			2
Current event										X	1			X								1
Communication network											0									X		1
Play games (Refer to *Project Wild*)									X	X	2											0

Themes

5.1 Teaching outdoors is an essential component of environmental education

Eight out of ten British Columbia participants and half of Taiwanese participants strongly favor the use of field trips and firmly believe they can enrich environmental education:

(BC) Become very familiar with a local park or beach and develop a program based on that area. (C1)

Experience based programs-taking students to exemplary field trip locations such as Bamfield. (C2)

Local research and action. (C5)

Field trip to garbage dump shows students the results of a wasteful society. Checking the local reservoir to show students need for a protected water-shed, and how valuable clean water is, and how acid rain affects our environment. (C6)

Field Trips. e.g., Beach clean-ups. Students love to feel they are playing an active part in environmental issues. (C9)

(Taiwan) Bringing students to visit places is effective for teaching environmental education. Since outdoor activities would have greater impact and memories for the students, the educational institutions should arrange more outdoor education for students in order to promote environmental education. (T1)

Bring students to visit places, in which students could understand the significance of protecting Earth by themselves, rather than limit in theoretical understanding in order to cope with exams. (T6)

There is evidence, however, that the Taiwanese teachers indicated taking field trips only as a break from classroom activities, while most British Columbia teachers emphasized taking field trips as an effective tool in conducting students in practical and long-term study.

5.2 British Columbia teachers regard collaboration as an effective strategy

The majority of the British Columbia participants and only one Taiwanese participant regarded collaboration as an effective strategy for teaching environmental education:

(BC) Develop partnerships with community members or organizations that provide their services to the school. Make use of speakers from UVic, Ministry of Environment, DFO (the federal Department of Fisheries and Oceans), Nature lists... Ask for environmental educators to build the program... Develop a partner or staff who you can work with and plan activities. Establish partnerships with parents early in the school year who get to know the students and understand classroom routines. (C1)

Assistance from resource people... i.e. meeting with Streamkeeper "leaders" of the field. -- Gaining new ideas and methods. (C2)

Because of my interest, I found some resources and got support from the community so that I could teach environmental education. Any teacher with the desire, and the support could do what I do. (C4)

Guest speakers. (C5)

Inviting guest speakers to talk about their experiences and to give slide shows. (C9)

(Taiwan) Arrange for students to attend conferences or lectures. Invite famous experts or parents who specialize in the environment to make lectures on campus. (T5)

5.3 Taiwanese teachers are inclined towards asking themselves to be resourceful

Most Taiwanese teachers emphasized teachers' lectures and modeling to improve students' environmental knowledge, or wished that the government could publish some environmental bulletins as a resource for students' reading, discussions, play dramas and presentations, as these are some of the students'

favorite activities as well as the most powerful and effective way to implementing environmental education:

> Teachers' modeling in their daily lives would be more ideal than their lectures for students, such as recycling and reducing waste. (T5)

> Teachers need training for teaching environmental education, so that they could be competent enough for environmental educators (e.g., capable of using effective methods and making media, such as slides and transparencies, suitable for teaching environmental education at the elementary level. Teachers could design a scene and let students experience it by themselves. Or they could design a similar concrete material and let students see or feel the environmental disasters caused by human beings. For example, when students turn on the switch of a model, many interesting things could one by one, occur in the model. As carbon dioxide increases, the temperature rises. Consequently, icebergs melt, the sea level increases, and flooding of low-lying lands occurs. This would be more powerful than pictures to impress students. (T6)

> 1) Teachers could provide several environmental topics for students to collect information and pictures on, and divide students into small groups to discuss their findings.
> 2) Teachers should immediately report the serious environmental issues in classes, and teach at the moment.
> 3) Using media, such as videos, movies and networks, is the most effective method of implementing environmental education.
> 4) The government should publish booklets or pamphlets, such as environmental history, stories and scripts, for students to read, report on, discuss and perform.
> 5) Personify the environment: Teachers could explain the relationship between the environment and human beings in order to guide students to take into account environmental ethics. (T3)

> Teachers should let students watch more videos about environmental issues, and daily teach them how to protect our environment. (T7)

> 1) Display recent information, such as pictures and data about environmental issues, that students could be moved by and make aware of the environment.
> 2) Provide students with information.
> 3) Have students work in small groups to discuss the environmental topics allotted by the teachers.
> 4) Ask students to report the research results in classes. Then, teachers review and praise students' efforts. As a result, students would eagerly engage in discussions of environmental issues, and improve their records.
> 5) Teachers need to limit the time of students' discussions and reporting, so that students would be competitive to prepare well for their performance. Most students are used to memorizing the information from the textbooks that they are good at answering the questions, such as true-false and multiple choices. Their examination performance is successful. However, when they face a world map or terrestrial globe, it is quit hard for them to point out where specific

> continents and oceans are located. They have no concepts of countries and cities mentioned in newspapers and magazines. Thus, their studies are not related to the reality of their lives. That's why I strongly consider that developing students' ability of map-reading is essential. (T8)

> Simulate an environmental event and ask students to role-play. Then, have students reflect on and express their experiences both in and out of the role. Students could demonstrate awareness and appreciation of their environment and also make connections between their situations and environmental problems. (T10)

5.4 Taiwanese teachers have greater difficulties in curriculum integration

As the previous findings reveal, British Columbia teachers are sometimes able to allot more time to teaching environmental education in classrooms by tying it to other subjects. This advantage of curriculum integration in implementing environmental education is understood by Taiwanese teachers but more difficult to implement. The comment of one Taiwanese teacher that "The social studies classes need to be taught by specialist social studies teachers" suggests that lack of background knowledge, or not seeing possibilities of curriculum integration may inhibit some teachers. One Taiwanese teacher in this study made the following comment about the role of teachers in teaching environmental education:

> Teaching environmental education is neither only a social studies teachers' responsibility, nor limited in social studies textbooks. In all subjects, such as Physical Education, Science and Language Art, teachers should be aware of curriculum integration, and help students recall their past experiences. How to effectively use these elements and change resistance to assistance for promoting environmental education, depends on the intelligence of teachers. (T5)

5.5 British Columbia teachers tend to regard activity projects as effective in implementing environmental education

Eight out of ten British Columbia participants and only one Taiwanese participant recommended activity projects as effective in implementing environmental education:

(BC) Teaching environmental education often is a series of unrelated lessons that are just fun activities. Students finish the activity and enjoyed what they did, but no long lasting effect is established with the students. Students need to take on a project, become involved, be involved in hands on activities, teach what they have learned to someone else and have the opportunity to tell as many people as possible about what they have learned...Use a program like the Classroom [Salmonids] Incubation Program to spark student interest and keep students focused... Develop action programs that encourage the students to take responsible action that allows the students to feel positive about what they have done. (C1)

Setting up a salmon tank for the Salmonid Enhancement Program. (C2)

I use lots of curriculum resources, including programs produced by the federal and provincial governments, such as Project Wild Activity Guide and Green Teacher... The better thing for students to feel helpful for environmental education is planting trees. Everyone can enjoy that and no one can ignore that...When they [students] realize what they are learning, leads to some worthwhile activities that are valued by the community, they feel good about themselves. (C4)

Practical workshop style e.g. Ministry of Environment "Air Pollution" (1997)-youth program... Earth Week activities, class or school based to bring the campus "alive" environmentally with poster displays etc. (C5)

Hands-on activities, looking at different samples of water: fresh water, salt water, top water. (C8)

Taking the text out of the text book and bringing it alive by assigning meaningful and exciting projects to include music, art, drama, debating and research. Getting the whole school involved such as; for celebrating Earth Day. Students love to organize events for the other classes to share. (C9)

(Taiwan) Since global environmental problems and issues are connected and constant, we who are part of the global village, have responsibilities to sustain a wonderful and healthy environment for the next generation. In addition to cooperatively solving global problems through national organizations, everyone should take some personal action to protect our environment. (T6)

Apparently, British Columbia teachers tend to regard activity projects that help the environment and effect a positive change as effective ways of implementing environmental education. Many British Columbia participants took into consideration that students must be involved in actions to develop positive attitudes toward the environment. Conversely, one Taiwanese teacher mentioned his obstacle of teaching environmental education that "students don't think that their efforts could have any positive results or make any difference". Comparing comments from both British Columbia and Taiwanese teachers, it is evident that students' hopelessness might be counterproductive to taking action.

Discussion

The results from this study yielded a number of outcomes worthy of discussion. Three major findings of this study are now discussed in terms of the participating teachers' perceptions, cultural differences and educational philosophy differences.

Teachers' Perceptions

According to the British Columbia Ministry of Education document, *Environmental Concepts in the Classroom* (1995), a framework based on the six principles is given for introducing environmental concepts into the classrooms. In order to forge closer links between the implementation of environmental education and cultural difference, I endeavored to analyze the findings which reveal the teachers' perceptions described below.

Direct Experience

Direct experience has been identified by many educators and researchers as a requirement for achieving learning outcomes such as knowledge, attitudes and skills (National Council of Teachers of Mathematics, 1970; Braun & Froese, 1977; Newhouse, 1990). Precisely, direct experience with the environment is the basis of learning for deeper understanding of natural systems and the impact humans have on those systems (B.C. Ministry of Education, 1995). In this study all of the British Columbia participants mentioned using experiments, outdoors and hands-on activities to enrich their students' experiences with the environment. In contrast, seven of the Taiwanese participants realized the importance of their students' direct experiences, however, they also responded that providing such an opportunity for their students, in fact, was difficult:

> ... the educational institutions should arrange more outdoor education for students in order to promote environmental education. (T1)

> 1) Lack of time to arrange students for a field trip. 2) It is difficult to find a place as to demonstrate environmental education. 3) There are too many bad examples of environmental pollution in the community. (T3)

> The best way of teaching environmental education is bring students to visit the places, and let students experience by themselves. Thus, the profound impressions would inspire their consensus to practice environmental education in the reality of their daily lives. Unfortunately, the school curricula are not flexible. (T4)

> It is very hard to have places and time for students to visit or investigate places.(T5)

> Students usually don't have old experiences with their environment, so teaching environmental education is not an easy task. (T6)

> It is ideal for providing kids an opportunity to do research projects, but it would take students much time to do so. Since each class period only has 40 minutes, students could not have enough time. (T8)

> Conduct a field trip to experience the environment...but it is not easy. Students are used to studying only the content from the textbooks instead of thinking more deeply. (T10)

Using the terms such as "ideal" and "should" in their descriptions, the Taiwanese participants felt that taking students on investigations or visiting places involved many obstacles they could not overcome, although it would be an opportunity for giving students direct experience.

In my experience, it seems that annual field trips might not be a part of environmental education, but rather are designed for diversion or fun. Thus, I called the Taiwanese participants to ask where their students' field trips occurred. They responded that field trips usually were arranged to many amusement parks where grade six students could have fun and a break from school. Eventually, I realized that in the Taiwanese teachers' implementing environmental education, field trips to give students direct experience with the natural environment were difficult to find.

There seems to be an absence of field trips to show students how badly the environment is polluted in their community or to guide students to test acid rain on campus. I wondered whether Taiwanese teachers are willing to teach the controversial issues which may provoke some residents or parents in their community?

Snively (1989a) has echoed the same concern that "Fear of offending community groups keeps many teachers from encouraging their students to take action". In addition, she throws some light on the way to lower the barriers to effective environmental education:

> You can try to find out which values the students, the students' parents, and the surrounding community prize. You can work toward creating a moral atmosphere in the school based on tolerance, respect, cultural diversity, and ultimately prizing key virtues valued at both the personal and the societal levels. Students should see the important role laws play in our society and that there is a method of resolving disputes fairly and peacefully. They should also understand that laws are always changing, as are the values of society.
> (Snively, 1989a, p. 102)

From this point of view, values should be seen both as causes of social behavior, and as an emergent product of social interaction. Such social interaction depends upon communication networks. In this study almost all of the Taiwanese participants mentioned that lack of communication networks is a serious obstacle inhibiting them from accomplishing the goals of environmental education. It is true, as one Taiwanese participant described, in Taiwanese society most people ignore environmental problems. For example, involved in a busy and intense lifestyle of industrial civilization, Taiwanese people do not have time to concern themselves about global problems and issues, such as the ozone layer and greenhouse gases. Not until the ozone treaties affect their export quantities, will there be any positive actions to deal with the significance of global issues. A Taiwanese teacher might find it somewhat difficult to win support from the community.

The Taiwanese people, however, are gradually taking a more concerned attitude towards the environment. Recently, the Taiwanese government was forced to drop its proposed construction of its fourth nuclear power plant because of public rejection of nuclear power plants. Taiwanese people are becoming cautious and antinuclear in their general attitudes. This rising awareness of environmental

issues is encouraging in light of the short history of environmental education in Taiwan. Many non-profit environmental organizations, such as the Environmental Quality Protection Foundation, the Chinese Wild Bird Federation, the Butterfly Conservation Society of ROC and the Green Consumer Foundation, have advocated many actions and plans for people's participation. Thus, nowadays building a communication and support network should be less difficult than before.

One example of growing community involvement is that in Taipei there is a women's group that includes parents, teachers and scholars in the community. For years, the members met on Sunday afternoon and developed environmental education programs to educate the community' children as "little soldiers of protecting the environment". This group is non-profit and the members are volunteer, yet the influence of environmental education is so significant that it gets space in the newspaper and attracts public attention. It is worthy of note that this group was pioneered by some teachers. This is evidence that teachers could overcome obstacles to build a communication network in implementing environmental education, and benefit children—the future public and society. Thus, teachers could eliminate resistance and make a difference in implementing environmental education.

Responsible Action

Hungerford, Peyton, & Wilk (1980) develop a set of four instructional goals for environmental education that have been validated and used over the last decades. The superordinate of these goal levels is to help students actually solve environmental problems and develop problem solving skills (p. 43). According to the BC Ministry's document, responsible action, the second principle for integrating environmental concepts into the curriculum, is "influenced by belief systems and personal limitations, both physical and cultural" (1995, p. 7). In analyzing both BC and Taiwanese teachers' responses, I found that all of the participants considered responsible action as a consequence of environmental education:

(BC) Hopefully students will make informed of responsible choices about the environment. (C2)

For children to really want to help keep the environment sacred they must care about it. (C10)

(Taiwan)They [students] should have the basic ability to judge the things [environmental issues] in general. (T1)

Students should be willing to solve the global problems and have the ability of solving these problems in order to protect our environment. (T2)

Have students gain basic knowledge, skills and attitudes towards the environment in order to promote environmental education and establish a clear and concise foundation of environmental education in the future. (T3)

...stir up their [students'] critical thinking to make rational and wise actions. (T4)

Teachers' modeling in their daily lives would be more ideal than their lectures for students, such as recycling and reducing waste. (T5)

...encourage students to take actions, such as demonstrating an understanding of protecting the environment, practicing in their daily lives, and influencing others. (T6)

> Have positive attitudes toward the environment, good behaviors and habits in their daily lives. Nowadays Taiwan's serious problems are... Most people are ...only caring about themselves...they don't care about the deteriorate environment. This degrades most people's quality of life. (T7)
>
> Ask students to report the research results in classes....As a result, students would eagerly engage in ... (T8)
>
> it is more important than before for the grade six students to foster the good habit of environmental protection, and practice that in their daily lives. (T10)

However, one Taiwanese teacher pinpointed the factor that taking responsible action for students is not easy:

> When they [students] see other children or adults breaking the correct processes of protect environment, they don't dare to advise them. Gradually, they also follow other incorrect examples. Thus, even though kids have enough knowledge taught by their teachers, they cannot practice to protect their environment in reality. (T9)

This finding will be discussed in the next section with the explanation of the student's response conditional matrix.

Understanding Complex Systems

Students need to study complex systems including the complexity and interrelatedness of natural systems and human-created systems, in order to "examine the origins and impact of their present world view and analyze the implications of new information and changing societal values" (B.C. Ministry of Education, 1995, p. 8). Helping students to understand complex systems is likely to be one of teachers' duties. All of the participants responded the same concerns:

(BC) Students must have a basic foundation knowledge to build on. There are a great deal of programs to teach this basic knowledge. (C1)

> Show students need for a protected water-shed. And how valuable clean water is, acid rain and affects on our environment. (C6)

(Taiwan) Students should understand the main factors of the effects of climate change. (T5)

> The environment has a very close relationship with our daily lives that changes to the environment will have a great impact and serious influence on our lives. Therefore, it is necessary to let students know that point since they are young, and also teach them how to confront and cope with the environmental problems in order to protect our environment. (T9)

Understanding the Consequences of One's Action

Through the study of the environment, students can explore the environmental impact of decisions and actions made at personal, community, societal and global levels (B.C. Ministry of Education, 1995, p. 8). In this study all of the participants mentioned the importance of helping students to understand human impact on the environment:

(BC) Students need to be involved in hands-on activities, teach what they have learned to someone else and have the opportunity to tell as many people as possible about what they have learned...The challenge is coming up with activities that can be integrated early into daily instruction and have meaning to the students. (C1)

> Students can connect their learning with the world around them and engage in critical and cooperative dialogue. (C2)

> These kids are one day going to be responsible for our fragile planet and need to understand that choices made now concerning the environment could/will have both short and long term consequences- both positive and negative depending on the choice. (C3)

> When they[students] realize what they are learning leads to some worthwhile activities that are valued by the community, they feel good about themselves. (C4)

> Students need to know the impact of using fossil fuels and alternative fuels...Show students the results of a wasteful society. (C6)

Have them think about what they are doing (Routines-what are they using/ where does it come from). To have them think about waste...Make them aware of the growing population and how much we're using our natural resources. (C7)

By imparting knowledge we are helping the child to make informed decisions about social and environmental problems. (C9)

I feel that children need to understand how important the environment is to them and their future. (C10)

(Taiwan) Environmental education should connect with the community...and parents. (T1)

We all are living in the global village. There is a very tight relationship bonding everyone. Students need to understand the environmental issues, problems and impacts that the global village faces. (T2)

The students we teach nowadays will play an important role in the twenty first century...they should learn how to cooperate with other people. (T4)

Students should understand the effects of rapid technology development, the examples of environmental pollution and issues in the global village, the effects of global environmental problems, and the reasons why we need to solve the global environmental problems for our future generation. (T5)

Students should understand the effects of improper use of resources in the global village. (T6)

...daily teach them [students] how to protect our environment. (T7)

...engage students in understanding environmental issues (e.g., pollution, use of non-renewable or renewable resources). (T8)

...the most effective way of promoting environmental education is for every level of bureaucracy in the country to mobilize and contribute to protecting our environment... to setting a good example for kids. (T9)

...it is necessary to cultivate / educate students to... be aware of the global issues... foster the good habit of environmental protection, and practice that in their daily lives. (T10)

Aesthetic Appreciation

An aesthetic appreciation of the environment, which is a sense of respect and appreciation for the natural world including the uniqueness and beauty of the planet, is one of the principles which the Province of British Columbia's ministry document states should be integrated in the classroom. The document also indicates that "outdoor education can help develop an aesthetic appreciation of the environment" (p. 9). It is unquestionable that "Direct experience in natural surroundings provide opportunities for students to develop respect and appreciation for living and non-living things". Almost all of the BC participants in this study recommended that field trips were the best opportunity for students to be given direct experience with the environment. However, only one out of ten Taiwanese participants described that "outdoor activities would have greater impact and memories on the student" (T1). Taiwanese teachers tend to rely on some form of technology or books to enrich their teaching:

> Using slides, transparencies and drama in teaching environmental education would evoke students' interests and attract them into the study. (T2)
>
> Using media, such as videos, movies and network, is the most effective method of implementing environmental education. (T3)
>
> Arrange students to attend conferences or lectures. (T5)
>
> Should let students watch more videos about environmental issues. (T7)
>
> Display recent information, such as pictures and data about environmental issues, that students could be moved and aware of the environment. (T8)
>
> Using multimedia, such as videos, transparencies and slides, in teaching environmental education could stimulate students' motivation of learning. (T10)

Modern technology is likely to be used to enable students' awareness in order to develop aesthetic appreciation of the environment, and display other modes of learning, especially firsthand encounters with living environments. However, UNESCO (1985a) indicates that computer simulation, "is usually designed to provide answers rather than to help participants be better understand the processes involved in arriving at answers" (p. 1). According to Brick (1991), most Chinese students "tend to look to the teacher and the textbook as providers of the correct answer"(p. 159). This finding might support the Taiwanese participants' responses that using media can be an effective strategy to provide answers for students' preview and review in order to achieve academic performance.

Colwell (1997) minimizes the difference between the real and the simulated experience. "Whether it be a pond ecosystem, a single leaf, or a city building, the question that decides how they are to be understood is not whether they are natural or cultural, but the particular ways in which and degrees to which they are interconnected" (p. 8). Thus, the difference between British Columbia and Taiwanese teachers' perceptions of integrating aesthetic appreciation in their classes could be a result of cultural difference. The British Columbia Ministry's document (1995) suggests one of the concepts of aesthetic appreciation for student consideration and discussion is that "Individuals and cultures vary in the degree the which they value nature for its own sake and for its ability to serve human needs" (p. 9). Perhaps whether teachers regard aesthetic appreciation in the classrooms is influenced by their environments, in which the natural environment plays a critical role. Living in a city which resembles a desert of concrete or living

in an area surrounded by nature might deeply impact whether teachers try to develop their students' aesthetic appreciation in the classrooms.

Developing an Environmental Ethic

Integrating environmental education in the classroom can encourage students to make decisions based on an understanding of the social conflict and environmental crises as well as their own values, and values of community members (B.C. Ministry of Education, 1995). Values issues could include economic growth and sustainable development, land ownership, consumption patterns and lifestyles, technological change, pollution, and the role of the media (p. 10). Almost all of the participants in this study responded that supporting students to recognize their own values linked to their decision-making process and future generations, is critical in their teaching:

(BC) Students need to...be involved in hands-on activities, teach what they have learned to someone else and have the opportunity to tell as many people as possible about what they have learned...The challenge is coming up with activities that can be integrated early into daily instruction and have meaning to the students. (C1)

Through direct experience students can develop an "environmental ethic" (C2)

...children like to take only one side, seeing in black and white, right and wrong... I have many booklets and handouts from Greenpeace...They have their own educational goals, and they are trying to influence people. So, we have to watch out for bias and controversies. (C4)

I also want them[students] to critically think about their own lives, in family and community to become more environmentally aware. (C5)

The more adept at making decisions the child becomes, the more she will appreciate her own role in society. (C9)

(Taiwan)How to educate students to have a clear and objective judgment is very important. (T1)

> Students should have the knowledge of geography and productions. By showing the interaction between these two clearly, students could learn the concept of environmental ethics. (T3)
>
> We should be aware of the long life and quality of our global village. (T5)
>
> Some developing countries whose developments of economics, hygiene and education are not simultaneous, cause people to suffer from famine and poverty... Although the rapid development of technology helps the economic movement, it also brings many environmental issues, like noise and air pollution. The reasonable uses of technology can improve human lives; otherwise, it would damage the world. e.g., bombs. Thus, we should be prudent of using technology. (T6)
>
> If they[most people] can get rich, they don't care about the deteriorate environment. This degrades most people's quality of life. (T7)
>
> Many people...are not aware that the global environment has changed since the old times. If they don't teach the kids with a global perspective, it would be difficult for students to have an appropriate attitude towards their environment. Meanwhile, the generation gap will become even wider. (T8)

Cultural Differences

In order to better understand the differences in the implementation of environmental education between British Columbia and Taiwan, it is necessary to work at developing an awareness of how some features of Taiwanese culture may differ from Canadian culture. Although a detailed ethnographic study is beyond the scope of this study, it is important to remember that the cultural differences in what is considered desirable, may have influenced the implementation of environmental education in British Columbia and Taiwan.

Perhaps the most pronounced cultural difference between Taiwan and Canada is the contrast between the Eastern emphasis on collectivism and the Western individualistic ideal. Singh, Huang, and Thompson (1962), in a

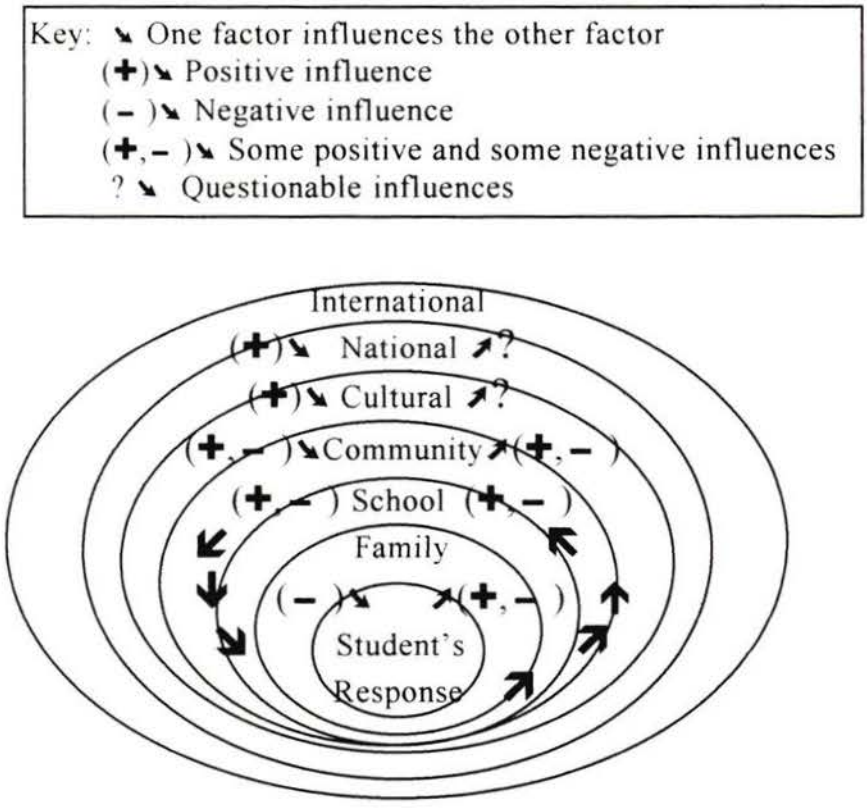
comparison of the values held by American and Chinese students, found that Chinese ranked highest in society-centered orientation, whereas Americans ranked highest in self-centered orientation and on the need for autonomy. Morris (1956) also found that American students were activist and self-indulgent in their values, and also less subject to social restraint and receptivity. This cultural difference in attitudes toward learning have likely been maintained throughout the past four decades. In the recent years, Stigler & Stevenson (1991) found that "In Taiwan, the teacher was the leader of the child's activity 90 percent of the time, as opposed to...only 46 percent in the United States" (p. 17).

More recently, according to Argyle, Henderson, Bond, Iizuka, & Contarello (1986), in the East there are more unwritten rules about obedience, avoiding loss of face, maintaining harmonious relations in groups, and restraining emotional expression. Given the evidence of differences between Eastern and Western codes of conduct, it is likely that Taiwanese implementation of environmental education places high value on obedience and contentedness in a context of highly competitive examinations. Standards of excellence and of what constitutes success may be determined both by the individual and "by significant others, the family, the group, or the society as a whole" (Yang, 1986, p. 114). Thus, "parents tend to view schooling as the process of training the child's intellect only and, consequently, regard nonacademic activities as distractions" (Pai, 1990, p. 170). As one teacher mentioned in this study that "Although in the past years, schools have promoted environmental education, such as recycling, families and society cannot support and encourage kids so that it is very difficult for kids to practice environmental

education in their lives" (T6). Such a student's response can be analyzed by a matrix. The conditional matrix is a shorthand device to help expose influences on a phenomenon in several directions. I use it as a working tool not as a final analysis because I find in this example the diagram quickly becomes too complex to be helpful. It is useful to help focus attention on focus at different levels.

Figure 23. Analyzing a Taiwanese Elementary School Student's Response through the Conditional Matrix

The student's response (paradigm shift) is influenced by factors in each of the concentric circles.



Let me now draw out some of the key relationships from this matrix. The Taiwanese student's response is influenced by factors in each of the concentric circles. Through the matrix we can trace the effects of conditions on each

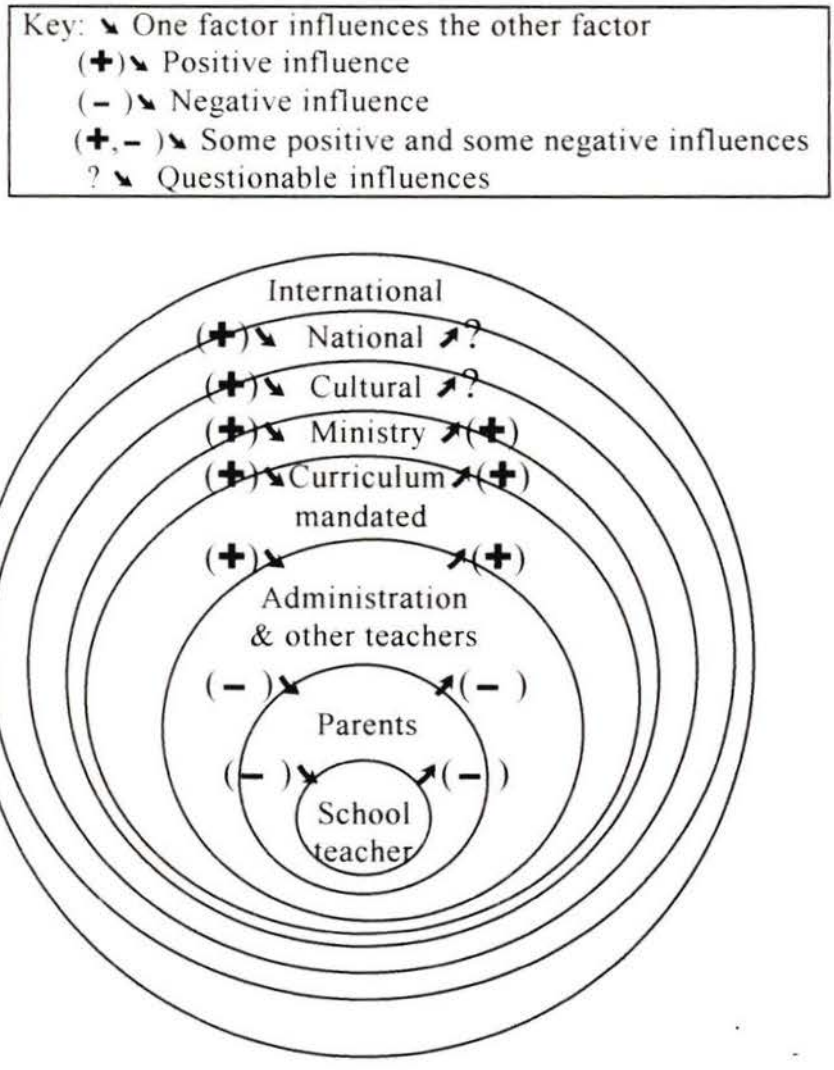
concentric circle. Beginning in the center with the student, we see, a (–)↘ indicates negative influence of the family on the student's paradigm shift. For example, that because recycling taught by teachers from the content of textbooks is of little importance to the students' families who only respect their children's academic achievement. Students are unlikely to take actions at home. But students may try to apply what is learned in school and thus influence the family albeit slightly. Therefore, the arrow from student to family is both negative and positive.

Moving to the school level, we find that recycling is part of a model of work, but students' field trips do not relate to environmental education. Thus, the arrow from school to student is both positive and negative. The arrow from student to school is also both positive and negative because authorized discipline in school fosters students' obedience but awards "Environmental School" for enriching the school's reputation. Next, we move to the community level and find that recycling is also limited, and the influence of adults modeling paradigm shift is small but some communities try to improve their environment. Therefore, the arrow from community to student is both negative and positive. At the cultural level, the effects of avoiding actions that might compromise relationships are seen in reluctance to challenge breaches of environmental law. On the other hand, strong community loyalty might be a great strength when social change begins to build.

Now, we move to the national level where the new environmental education guidelines originated in response to the inception of an "Ozone Depletion Treaty". We can find a relationship between the Ozone Depletion Treaty and the work of

an elementary school classroom by tracing downward through each of the conditional levels. Likewise, a Taiwanese teacher's implementation of global environmental education can also be analyzed (see Figure 24) to understand what conditions in a general sense relate to their obstacles.

Figure 24. Analyzing a Taiwanese Elementary School Teacher's Implementing Environmental Education through the Conditional Matrix

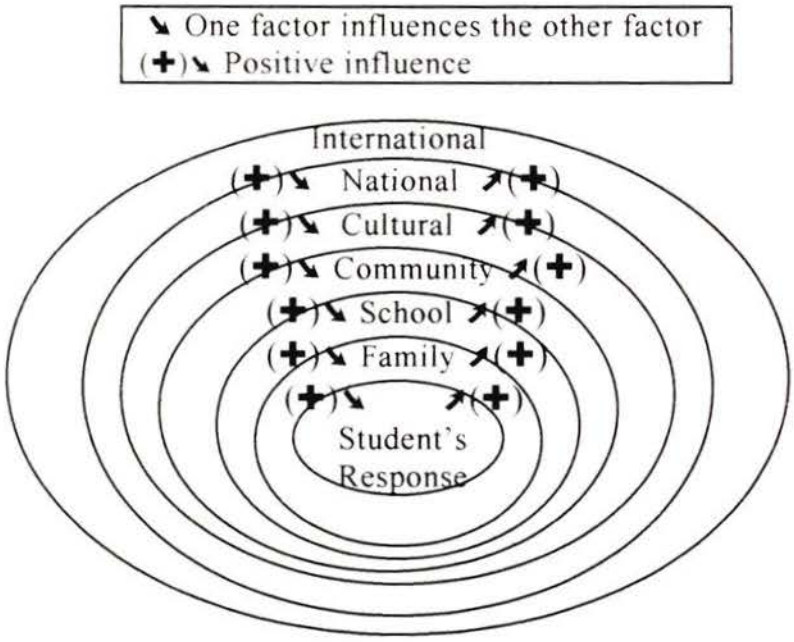


Beginning in the center with the school teacher, the arrow from family to school teacher is negative. For example, the Taiwanese participants responded that parents did not support the implementation of environmental education. Next, we

move to the administration and other teachers level where integrating environmental education across many subjects is not easy. Thus, the arrow from administration and other teachers to the school teacher is negative. Now, we move to the curriculum mandated level and find the two arrows indicating positive influences between Administration and the Ministry of Education, because environmental education is mandated to be taught at all elementary grates in the classroom. At the Ministry level, the arrows from international, national and cultural levels to Ministry of Education are positive in response to the inception of an "Ozone Depletion Treaty". Yet at the cultural and national levels, the influences are questionable because the Taiwanese rely on "human feelings" (jen-ching-wei) which preserve relations between people, yet ineffectively prevent the pollution from their environment. Not until a strong and precise policy affects people's life, might there be any positive actions to deal with the significance of environmental issues.

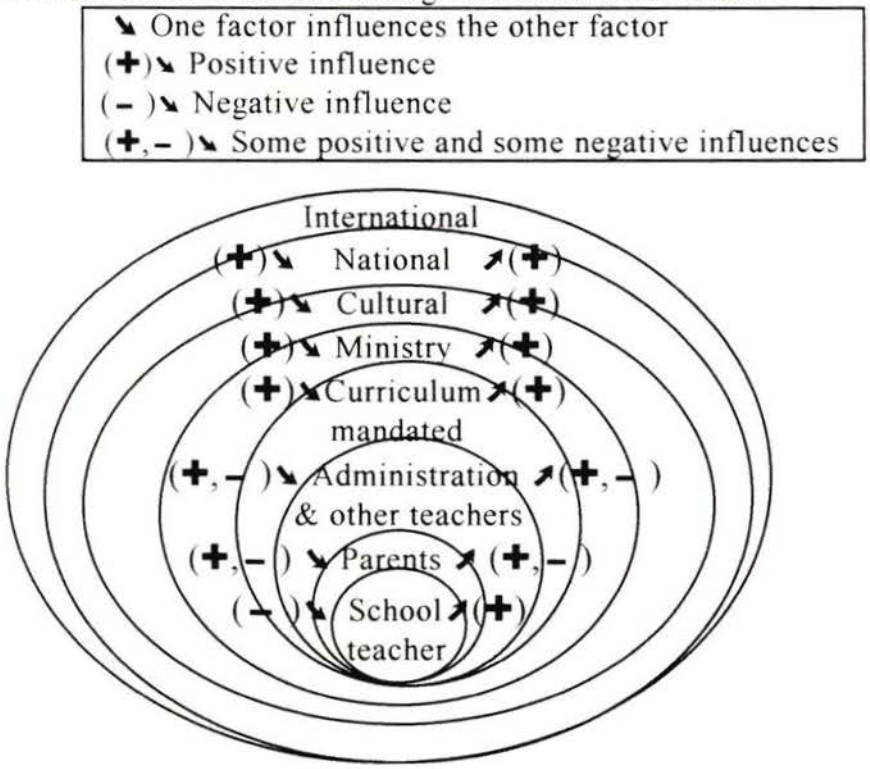
In contrast, British Columbia implementation of environmental education emphasizes the rights of individuals and the questioning of authority, such as teachers working with students to create a checklist and rating scale to assess students' work on writing a class letter to a newspaper editor (B.C. Ministry of Education, 1996, p. 55). Using the conditional matrix to pursue the relevant task, a BC school student's response is more in the direction shown in Figure 24 because in general the teacher, school, family, community, culture and government offer supportive statements of positive environmental change.

Figure 25. Analyzing a British Columbia Elementary School Student's Response through the Conditional Matrix



The teachers' implementation of environmental education can be seen:

Figure 26. Analyzing a British Columbia School Teacher's Implementing Environmental Education through the Conditional Matrix



The school teacher is the central focus, and affected by all of the surrounding conditions. Although British Columbia school teachers seem to implement environmental education more easily than Taiwanese teachers do, nine out of ten of the British Columbia participants mentioned about obstacles, including too many district policies on field trips, lacking time and funding (see Table 19, p. 116). Thus, influences on the implementation of environmental education in the matrix are both positive and negative in British Columbia. The teacher influences the parents through the child and through parent involvement in the classroom. Teachers are able to influence administration and other teachers through meetings and professional development days. Teachers have input into curriculum changes and eventually the education of children affects the culture and in turn, national policies.

As a result, it is evident that in this study cultural factors affect both British Columbia and Taiwanese children's learning outcomes. Developing effective instruction must take into account the profound influence culture has on how students learn and develop. Also, some of these determinants are so embedded in culture that perhaps the Western concepts of global education simply cannot be applied in Taiwan. There needs to be a Taiwanese form of global environmental education that will suit Taiwanese culture. Not only does this finding connect to the cultural determinants of learning outcomes that I try to explore, but it also encourages me to take a closer look at the educational philosophy differences between the two cultures.

Summary

The differences in teachers' perceptions, cultures and educational philosophies between British Columbia and Taiwan supplement my observations, interviews and questionnaires, in developing a grounded theory (Strauss & Corbin, 1990, pp. 48-53).

Taiwanese culture emphasizes harmony and obedience as the values of society, while Canadian culture elevates the right of individuals and permits questioning of authority. This cultural difference influences the goals of both British Columbia and Taiwanese education in that Taiwanese education aims to prepare children for social roles and to develop a sense of personal responsibility, while British Columbia education emphasizes children's needs and attempts to create a natural and free environment as a students' learning laboratory. Consequently, Taiwanese education puts an emphasis on mandated curriculum to help teachers as role models with strong discipline to implement environmental education, while British Columbia education provides many suggested instructional and assessment strategies and learning resources in the curriculum IRP for teachers as facilitators to integrate environmental concepts into their daily lesson plans. Understandably, social events in supporting environmental education for both cultures are also different, such that Taiwanese social leaders plant trees as a way to model behavior, while the British Columbia elementary school students learn by planting trees.

Overall, the differences of teachers' perceptions, cultures and educational philosophy between British Columbia and Taiwan are likely to affect the

implementation of environmental education. How we use these findings in the study in facilitating the implementation of global environmental education depends on our understanding of the cultural determinants of learning outcomes. These findings will be expanded in the next chapters of implications and recommendations for further research.

CHAPTER FIVE: SUMMARY AND IMPLICATIONS

United Nations Educational, Scientific, and Cultural Organization stated at the 1980 Paris Conference that :

> There is no universal model for the incorporation of environmental education into educational process. The approaches, procedures, and progressive stages of integration must be laid down in light of the specific conditions, ultimate aims, educational, and socioeconomic structures of each country (UNESCO, 1980, p. 35).

This study attempts to identify cultural determinants of learning outcomes in environmental education. Analysis of the data reveals several broad patterns noted in the previous chapter. This chapter attempts to make connections among the findings, literature review and the research questions. It is organized into four areas: 1) the goals of teaching environmental education; 2) the obstacles in implementing environmental education; 3) the effective strategies of teaching environmental education; and 4) the similarities and differences in environmental education at the grade six level in Taiwan and British Columbia. The purpose of this chapter is not simply to repeat these findings, but to draw out a more general theoretical implication.

The Goals of Teaching Environmental Education

The goals of teaching are different in individual cultures, yet developing positive attitudes is stressed in both of British Columbia and Taiwanese teachers' goals of teaching environmental education. The high degree of correlation

between groups of subjects supports strong consensus and suggests that similar results might be found with a larger sample. Goals are affected by perceptions of the role of education. A central goal of Taiwanese education is academic success, while in BC, participating in social change is a significant goal of education. Perhaps this difference is influenced by approaches to teacher education.

The Obstacles of Teaching Environmental Education

The teacher participants agree with the literature that lack of teaching time and knowledge were obstacles for teachers implementing environmental education. Taiwanese teachers complained of too many mandated materials in the textbooks and too great an emphasis on examinations and reviews to help students to achieve academic performance. It was somewhat surprising, therefore, to find that lack of resources in teaching environmental education is a greater obstacle in Taiwan than in British Columbia. The resources Taiwanese teachers need focused on field trip sites and up-to-date materials to demonstrate environmental education. According to the *British Columbia Assessment of Social Studies 1996 Technical Report* (B.C. Ministry of Education, 1997), 86% of elementary school teachers indicate that they have access to a district resource center, and about 85% of them rated the resource center in their district as fair to good (p. 112).

In contrast, although both of the Taiwanese Ministry of Education and the Taiwanese Environmental Protection Administration have their own environmental education web site as described in Chapter 2, and the National

Taipei Teacher College also has an environmental education center, Taiwanese participants in this study seem not to utilize them. Perhaps every Taiwanese elementary school needs to establish a resource center in order to provide teachers with information in implementing environmental education. This is considered as an recommendation described in the next chapter.

Comparing the science curricula between British Columbia and Taiwan (see Table 7, p. 40), local living and non-living resources are explored by the British Columbia five grades. Taiwanese students lack opportunities to investigate local environmental quality, and to demonstrate their ability to apply scientific skills and processes in order to present relevant and accurate information to support their views. Teaching controversial issues and using field trips to explore environmental problems, could enrich the students' knowledge and help to develop their abilities of the critical thinking and decision. This would be a challenge for Taiwanese teachers. Moreover, most Taiwanese parents do not seem aware of the importance of environmental education, and only reluctantly support teachers in implementing it. They are not supportive of their children taking social actions. This is what the Taiwanese teachers meant by lack of communication networks being a serious obstacle to supporting their implementing of environmental education.

The Effective Strategies of Teaching Environmental Education

The participants in this study enthusiastically provided many effective strategies of teaching environmental education. Although different teaching strategies are used in different cultures, the use of media, outdoor activities, and examination of current events are commonly preferred by both British Columbia and Taiwanese teachers in the implementing of environmental education. Technologies such as audio and video equipment are also considered to be powerful tools in effective teaching and learning. These technology-based products could effectively assist elementary school students in constructing academic and global perspectives that enable them to use knowledge to conceptualize contexts of environmental issues or phenomena which cannot be directly experienced by most students.

Also, the research findings show that current events provide up-to-date information and could be used as an effective tool in implementing environmental education. The comparison of British Columbia and Taiwan by the teaching strategies of the grade six social studies curriculum shows that British Columbia students are encouraged to use the Internet to do research, while Taiwanese students focus on the content of the textbooks. Perhaps this relates to the finding that lack of resources in teaching environmental education is a greater obstacle in Taiwan than in British Columbia. The Internet seems hold the potential to become a powerful tool of environmental education. Not only might it allow the collection of up-to-date information and current events to enrich environmental knowledge

and skills, but it also provides an opportunity to connect with other people in the world. As Biggs (1995) in his comparison of Asian and Western students warns, Asian school systems and students will have to meet the challenges presented by post-industrial society. Taiwanese education might need to adapt to post-industrial educational requirements such as using computers to expand the global environmental education. It is worthy to note, however, the more we increase computer simulations, the more we separate from natural world. The basis of learning in environmental education is through direct experience with the natural environment to develop respect and appreciation for living systems.

The Differences in Strategies of Teaching Environmental Education between British Columbia and Taiwan

Research findings show that teachers' interests, desires, knowledge and demonstrations influence their teaching of environmental education. Since this study does not include a comparison of students' knowledge and attitudes toward the environment between British Columbia and Taiwan, my conclusions of what strategies of teaching environmental education are effective are not complete. This is an area for future research.

Fortunately, the Taiwanese Ministry of Education announced in October, 1998 that a new curriculum will be implemented beginning in 2001, providing a high-quality education system for all students in Taiwan, where schools will have

the freedom and the flexibility to design programs and instructional strategies in order to integrate all subjects for students' achievement ("The new curriculum," 1998). The high school entrance examinations have been canceled. Thus, grade nine students after graduating from middle schools, must apply to enter high schools. It is somewhat disappointing that there is no emphasis on students' participating to the level of their maturity in their society, nor of taking responsible actions, doing research and reporting on how measuring instruments are used in the community as are recommended by British Columbia Ministry of Education documents (1995b & 1996b).

Developing a Theory

The literature reviewed and data analyzed in this study lead me to propose that cultural differences strongly influence how teachers implement environmental education and determine the learning outcomes.

There are six elements that might be identified to be cultural determinants of learning outcomes:

1. The goals of environmental education are determined by the cultures.
2. The role of teachers in the communities determines how environmental education can be taught.
3. The values placed by parents on aspects of education determine the learning outcomes of environmental education.

4. The values of the individual versus society influence how teachers implement environmental education.
5. Traditions affecting the process of social change such as interpersonal behaviors and attitude toward authority, influence the learning outcomes of environmental education.
6. Value accorded natural environment affects learning outcomes.

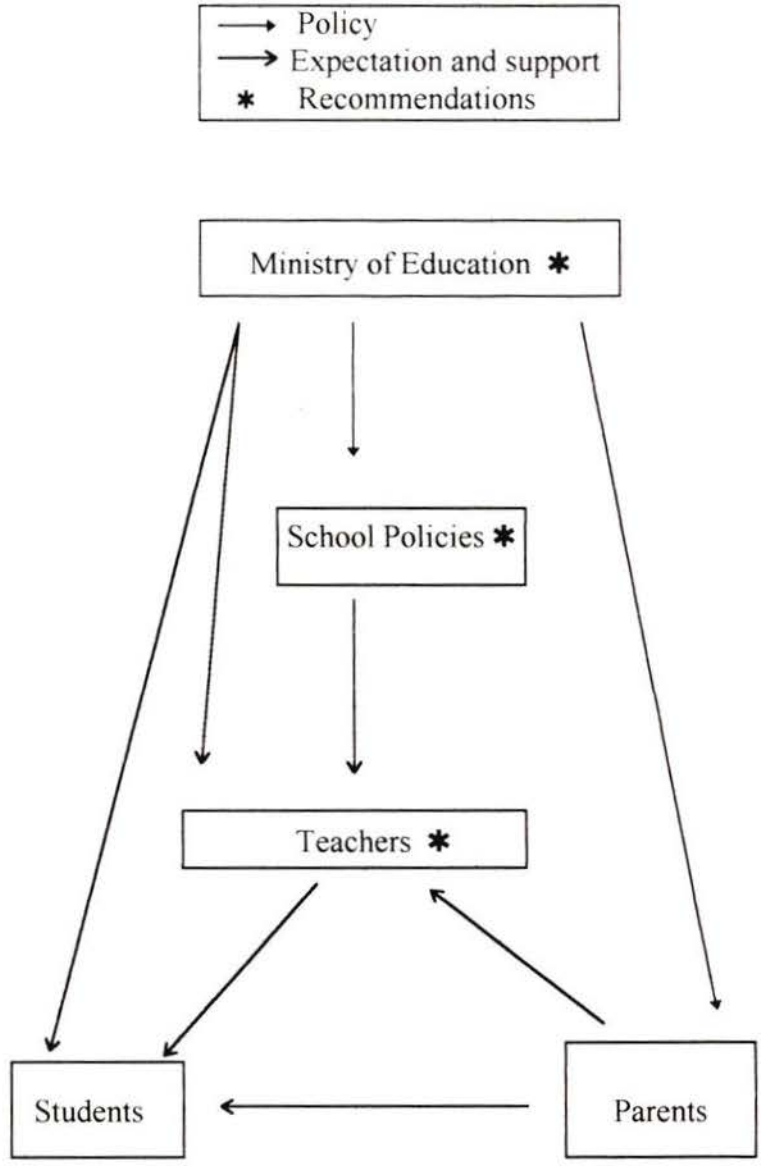
Applying Theory to Strategy in Taiwan

The overwhelming influence of education in Taiwanese culture reveals that the Ministry of Education, school policies and teachers affect students in a profound way. On the positive side, this may provide important and powerful support to environmental education if we infuse an environmental policy into the Taiwanese educational system with a top-down strategy. For example, as described previously, Taiwanese people were affected by an Ozone Depletion Treaty and took actions to deal with global environmental issues. In another example, the Taiwanese Vice- President recently advocated the "Green Citizen Income GNP", that the accounting of citizen income GNP needs to take the degree of his or her polluting environment and wasting resources into consideration; otherwise, as citizens receive more income, the environment becomes more polluted ("The Vice-President' s advocacy", 1999).

Likewise, it is suggested that the Taiwanese Ministry of Education may echo the Taiwanese Vice-President' s advocacy and add an environmental policy

(see Figure 27) to the requirements of high school entrance: students need the experience of taking environmental actions in their communities.

Figure 27 . The Theoretical Progression of Taiwanese Environmental Policy and Its Influence on the Implementation of Environmental Education



Thus, parents would expect teachers to help their children to participate in caring for their local environment. They would also support their children to do research and report on monitoring the degree of pollution in their communities.

During this top-down process, the government would encourage parental and community involvement in student action projects so that families would not feel that they are being judged for their lifestyle choices, but rather that they are part of the environmental problem solving process. In the context of social interaction, school policies would support teachers and students so that the action plans students develop could get the acceptance and approval of school administrators and staff. The Taiwanese Ministry of Education would support teachers with learning materials and resources suited to their local environment, and encourage students to visit its environmental education web site to participate in the various environmental activities and to access information. More detailed recommendations for the Ministry of Education, school policies and teachers are described in the next chapter.

Using an appropriate strategy to help Taiwanese students incorporate an environmental ethic is important theoretically, because an inappropriate strategy has the potential to undermine the applicability of a grounded theory to Taiwan. For the Taiwanese people, a focus on society, children's academic achievement, and human-centered rather ecosystem-centered educational philosophy, creates an urgent need for reinforcing the external environment, such as the public and society positively influencing students' attitudes toward the environment. Students would be likely to commit themselves to environmental studies if such subject

matter was strongly supported from the top. With top down insistence on environmental studies and action, not only could students develop the kinds of environmental concepts advocated in BC in their daily lives, but many obstacles mentioned by the Taiwanese participants, such as building a communication network, teaching controversial issues, collecting resources, arranging environmental field trips and role-playing might also be less difficult to overcome.

As environmentalists say: "There is no such thing as a free lunch." Being dissatisfied with the Taiwanese crowded, polluted and traffic-congested environment, Taiwanese people may be really to demand and sustain a healthy environment. Increasing the influence of environmental policy might cause resistance from parents, residents, business and industry leaders, however. The recommendation for the Ministry of Education to promote this policy is described in the next chapter. It is hoped that eventually residents and leaders of industries and communities might appreciate students' efforts on the improvement of their communities.

CHAPTER SIX: RECOMMENDATIONS AND CONCLUSION

This chapter is divided into nine parts: recommendations for 1) the Taiwanese Ministry of Education; 2) the British Columbia Ministry of Education; 3) general recommendations for school policies; 4) Taiwanese school policies; 5) British Columbia school policies; 6) general recommendations for teachers; 7) Taiwanese teachers; 8) British Columbia teachers; and 9) suggestions for further research.

Recommendations for the Taiwanese Ministry of Education

1. Address and Monitor the Implementation of the Environmental Policy

Introduce the Environmental Policy, a requirement of students' experience on taking environmental actions for high school entrance into the public, with the involvement of the media, such as newspapers, TV, bill-boards and school-boards, in promoting this policy. The fundamental importance of encouraging students to take environmental actions towards a sustainable society must be recognized and endorsed by the public. Not only has the policy the appeal to mobilize parents to support it, but it also helps opposing views reach a consensus.

Provide curriculum that includes student action and community involvement as well as content. Monitor the process to maintain a collaborative atmosphere in order to support students, parents, teachers and school policies.

2. Enrich Textbooks and Teacher's Guides

Some of the approaches used in BC classrooms may be useful to enrich Taiwanese environmental education, such as integrating subjects, using role play and simulation games, using resources (e.g., *Project Wild Activity Guide*, *Clearing*, & *Green Teacher*), developing long-term programs, building communication networks, and engaging students in selected action activities. Some of the vivid instructional strategies, assessment strategies and interesting learning materials and resources available in BC should be considered for inclusion in the teachers' guide.

Some domestic non-governmental environmental education organizations could be noted in the textbooks. Not only could such organizations help students to appreciate others' efforts, including successful actions, techniques and methods (e.g., British Columbia Destination Conservation program and environmental monitoring projects mentioned in Chapter 2) in protecting the environment and concern about the environmental problems that we need to solve, but they could also encourage students to take actions effectively and responsibly.

Provide teachers with a natural environment handbook to furnish teachers with a rationale for using the local environment as the context for integrated learning. Such a handbook offers the possibility of closing the nagging gap between education's potential and its less promising reality. Help teachers to consider that environmental education can take place in a garden in the city to develop an awareness of the urban environment (B.C. Ministry of Environment,

1980, p.5). In the heart of urban areas, parks, gardens, wastelands, and railway lines all provide havens for a range of animals and a huge variety of plants, that may provide an ecology for children to study. In addition to these urban environmental studies, Yangmingshan Mountain national park situated near Taipei provides a wildlife habitat, for such species as the Taipei tree frog, Asiatic sparrow hawk, Formosan blue magpie and hundreds of butterfly species as well as a large variety of insects, creating for the students an ideal natural field trip site. This might help students to learn from their firsthand encounters, reflecting on what has been seen, touched, read, moved, smelled and heard. Teachers need to understand why the natural settings in the urban areas are an appropriate and important learning environment.

Help teachers integrate curriculum by clearly noting environmental education units at every level of the teachers' guide. List resources in the teachers' guide, such as booklets, charts, bird watching guides and local park maps published by the Taiwanese Environmental Protection Agency as a supplement to environmental education. Such a design may help teachers to interest and motivate students by raising their awareness, facilitating analysis and encouraging action at the local level. Provide instruction and orientation to the use of the web sites already available as teacher resources.

3. Support the Implementation of Environmental Education to Schools

Provide supplemental materials to elementary school students for reading, discussions, and displays in classes. Provide media, such as videos, slides and transparencies to teachers for implementing environmental education.

4. Emphasize Participatory Education

Emphasize participatory education, hands-on activities and experiential learning in the criteria of annual awards for outstanding environmental education in schools. Students could be given direct experiences in order to forge closer links between the educational experiences and real life.

Invite prominent people to set models for students in the implementing of environmental education, such as planting trees at local parks, joining the celebration of Earth Day in their communities, participating in natural field trips, and giving natural educational books as presents. Use respected leaders to encourage students to take part in environmental education programs.

5. Improve Information Technology

Improve programs of information education in elementary schools, such as teaching students how to use the Internet. In addition to having an environmental education web site, and announcing that English language instruction will be introduced in Taiwanese elementary schools by 2001 ("The new curriculum,"1998). The Taiwanese Ministry of Education (1997a) needs to

encourage teachers to teach how to find international information. When students are urged to use the Internet they are invited to move their education beyond the content of the textbooks and engage in participation action, they are given the opportunity to synthesize environmental knowledge and skills to evaluate sources of information, and are taught both to follow and to lead as members of a global learning organization. This powerful and ideal research tool of environmental education has the potential to help schools manage the transition to a postindustrial world.

Recommendations for the British Columbia Ministry of Education

With some hesitation, I offer as a newcomer, some recommendations from the Taiwanese experience.

1. Provide More Content

It is my impression that more supplemental materials about up-to-date environmental resources for teachers would be helpful in implementing environmental education. Not only could background material benefit teachers' teaching, but also encourage teachers to tie environmental education to all their subjects. Teaching simple taxonomy and botany as part of the study of the natural world could enrich environmental education.

2. Support More Guidance on Dealing with Controversy

Provide more instructional strategies and examples of dealing with sensitive issues to teachers for facilitating students' decision-making and action-taking. Resource materials on critical thinking are important in this regard.

General Recommendations for School Policies

1. Understand Teachers' Crucial Role in Implementing Environmental Education

District board offices and school administration can play an important part in the implementation of environmental education. To provide support, it is essential to understand the obstacles that teachers face. Public acknowledgment of the significance of environmental education programs would help teachers working to implement the curriculum. Recognition that strong collaborative structures within the school and community are vital to the success of implementation of environmental education would also help to make such collaboration a higher priority. The principal plays a key role in developing collaborative cultures, modeling, sharing decision making, encouraging action-taking, promoting professional development in the broadest sense and valuing teachers and students' efforts in environmental education.

2. Regularly Report Environmental Education Activities within Community Newspapers

School newsletters and local newspapers are the ideal tools to improve communication networks for students, teachers, parents, the community members and scholars. Not only could students' environmental activities, performance and feedback papers display to communities that parents have pride and confidence in schools, but they could also motivate students' actions and develop people's positive attitudes toward the environment.

3. Emphasize the Action Learning Triangle

Whether students' participation action is positive and successful depends on school programs. The British Columbia school students' action education (see Table 3 , pp. 24-25) is a good example. Hammond (1997) cautions that school programs need to emphasize the Action Learning Triangle, a triangular relationship composed of three domains of learning environmental education: learning about action, learning through action, and learning from action. Schools should collaborate with teachers and mentors to coach students to learn action skills and strategies, involve themselves in an effective action project, and assess the significance of project outcomes and processes. Thus, students might be empowered by positive action experiences and persistently encouraged to take actions.

Recommendations for Taiwanese School Policies

1. Establish a Teaching Resource Centre

Schools should establish a teaching resource centre within a district or area, including all of the textbooks, teachers' guides, learning resources and other materials, such as media made by teachers in implementing environmental education. This centre may provide teachers an opportunity to be familiar with issues in the curriculum and help them in their attempts to integrate curriculum as well. Teachers' efforts in environmental education programs could be shared with other teachers, and also improve their teaching strategies.

2. Support Students' Field Trips

A successful field trip needs accurate plans, flexible schedules, and collaboration, including students, teachers, and assistance people working in harmony. Some research (Snively, 1978; Berliner & Piñero, 1985; Environment Canada, 1987) suggests, with preparation and guidance field trips can be worthwhile learning experiences for children. Schools should recognize the significance of field trips, and look for natural and educational locations for field trip sites. Invite environmental educators to coordinate the activity program, and contact organizations to assist and demonstrate environmental education. Not only might students have meaningful field trips and be aware of the environment, but teachers could also be trained in implementing environmental education.

3. Develop Long-Term Programs

Schools should develop long-term programs for students. For example, schools might initiate the first grades to adopt plants on campus. During six or seven years at the school, students might learn to be responsible for caring about the environment. Especially in the urban cities because of over-crowded housing and heavy traffic, students hardly ever experience planting trees. Schools could develop long-term environmental education programs in which students can choose and adopt plants on campus. Students could learn to be responsible for daily watering plants. Such a program relating to physical, biological and social environments, and their interactions, not only provide students a worthwhile experience to protect their environment, but also could approach the goals of environmental education: develop awareness, knowledge, skills, attitudes and participation.

Recommendations for British Columbia School Policies

1. Mark Plants on Campus

Environmental education does not only exist in out-of-school activities. On campus, elementary school students might have direct experience daily with the natural environment. Schools might mark the plants on campus with their identification and encourage students to care for the plants. In the meanwhile schools might integrate botanical knowledge with environmental education.

2. Support Students' Outdoor Activities

Simplify the procedures necessary for teachers to complete when they register for students' outdoor activities. Help students raise field trip funds and support the budget.

General Recommendations for Teachers

1. Have a Vision

The visionary, committed teachers in both countries seemed the most effective in implementing their respective curricula.

2. Be Familiar with Integrating Curriculum

Teachers need to be familiar with materials their students have learned and will learn so that they can integrate subjects and reinforce the implementation of environmental education. Not only would teachers prepare as well for their teaching and feel more confident in implementing environmental education, but their students could also help them refresh their old experiences and enhance their learning.

3. Develop Action Programs

Teachers should meet with the administration, staff and colleagues to establish priorities and develop action programs for students in implementing environmental education, especially arranging meaningful and educational field trips. Elicit feedback from teachers and students. Gather information from student performances and parents' suggestions. Reevaluate environmental education programs and plans regularly. Teachers must collaborate within the school to ensure that students do not repeat activities in another grade. The activities, such as studying the ecology of a window box and planting plants, could be clearly listed in the activities suggested. For example, first graders might plant herbs and study the life cycle of the butterfly, while sixth graders may hold a plant sale as a fund-raiser for the garden (Hanscom & Leipzig, 1994) and build bird houses.

4. Establish Classroom Resource Centre

Teachers help students establish a resource centre in the classroom, including environmental education magazines, reference books, newspapers, maps and videos. Not only would this encourage students to enrich their environmental knowledge, but also provide research materials for students' assignments and discussions.

5. Work to Develop Collaborative Structures within the School and Community

Teachers should help students feel more interested and fulfilled in learning environmental education. Snively (1989b) offers a powerful warning:

> The education of a child is a beautiful complex thing... The richness of interactions between teachers and learners— between learners and the environment— is so overwhelming that it cannot be communicated by standard means. Reading, writing, arithmetic, music, and science are indeed inadequate to transmit all there is (Snively, 1989b, p. 14).

Teachers must therefore strive to provide holistic learning experiences for students when implementing environmental education. Teachers should facilitate sharing the resources of environmental education with others, such as lending videos and magazines to other classes, organizations and parents. Invite experts and environmental educators to give lectures and demonstrations. Communicate schedules, activities, programs with community members, parents, scholars and colleagues from whom teachers could gain support and build a communication network in implementing environmental education.

6. Develop Critical Thinking Approaches to Evaluating Controversial Issues in Classes

Teachers should explore the public media for articles that students could assess with regards to bias, relevance, fact versus opinion, and accuracy. Students should also be able to distinguish points of view, show respect for, and evaluate the view of others, and generate alternative solutions to environmental problems.

7. Enrich Teaching Methods

Environmental education could be interdisciplinary and multidisciplinary thus demonstrating that it is not limited strictly to textbooks or subjects. The obstacles of lack of teaching time and knowledge may be alleviated through teachers' engaging in environmental education across the curriculum. Many effective strategies of teaching environmental education provided by both British Columbia and Taiwanese teachers in this study, such as directing students to work with one or two concepts clearly, using mass media to conduct efficient environmental education programs for students, actively asking collaboration, developing hands-on activities, and integrating curriculum and current events in classes, could be considered to enhance teachers' implementation. This may reduce the obstacle of lack of resources some teachers face, and attract students' attention to global environmental issues, particularly in their daily lives. Not only would teachers provide information to the students, but also remind the students to be aware of the global environment.

8. Coach Students to Make Decisions Locally and Globally

Teachers should coach students to decide how to spend their limited time and precious energies to ensure a successful action experience. Hammond (1997) puts the thinking about the place of action in environmental education this way:

> We should ... ask, 'Will this process and the results be good for children, all people, wildlife, water, air, forests, the

> school, the community, the country, the planet, all life and living, the earth's restoration and sustainability?' If the answer to these questions is yes, then commit to action and do it well (Hammond, 1997, p. 14)

If elementary school students can take actions towards this global thinking, a global environmental perspective would be infused into educating for the significant action in the future well-being.

9. Have Patience

Implementation of environmental education takes time. It is possible that students operating in local environmental education programs can be helped to reach a global environmental perspective. If teachers are enthusiastic and patient in teaching environmental education, students are likely to have opportunities to care about the environment.

10. Model Your Own Appreciation of the Environment

Having plenty of natural resources, and other resources, such as vivid instructional strategies, various assessment strategies and interesting learning resources provided by the Ministry of Education (Appendix M), teachers should appreciate the resources, and use them in implementing environmental education. Teachers must continue to educate themselves about global environmental issues as a life long learning and to model their own appreciation of the environment.

11. Teach in Students' Daily Lives

Environmental Education should be relevant to children's daily lives, not only in field trips or in environmental events. For example, some British Columbia students often purchase canned soft drinks which not only provide less nutrition than juice or milk, but also require recycling. In contrast, Taiwanese culture has something to offer here. Taiwanese students are used to bringing kettles with water to school. This routine is not only because Taiwanese tap water is so polluted that students are not allowed to drink it, but also because of the Taiwanese culture: students should bring kettles in schooling and outdoor activities. If changing a little lifestyle can save money and benefit personal and global health, perhaps BC teachers should encourage students to do so.

Recommendations for Taiwanese Teachers

1. Maximize Opportunities for Teaching Environmental Education and Engage Students in Environmental projects

Unlike British Columbia teachers, who integrate many subjects and tie environmental education into their lesson plans, Taiwanese teachers are expected during an exact time arranged on the school schedule to teach entire textbooks including environmental education. Teachers might infuse some new methods to engage students in local projects to improve the environment. For example, in the textbook, the unit of "Our Global Village" is implemented during April and May.

It is prudent to support the promotion of Earth Day with the teaching of environmental education in the Taiwanese grade six social studies classes about how relevant Earth Day and its related activities are to the students. This would be an important step if acted upon by teachers. As Ashford (1995) states:

> Tomorrow's citizens will need to be able to analyze the merits of conflicting claims and the values on which they are based... Teachers can have a powerful impact on these perceptions. They can reinforce despair by implicit agreement that all of us are helpless, or they can offer hope by demonstrating that they are convinced that our actions make a difference. (Ashford, 1995, pp. 75-76)

Teachers should encourage students to participate in environmental events, such as Earth Week, to help them improve their skills of joining social action, and help them become more integrated into long-term environmental education programs.

2. Discuss with Colleagues

Before the beginning of every semester, teachers should discuss with their colleagues which materials in the textbooks they need to teach rather than teach the entire textbook so that they could arrange more spare time for students' discussions, display, presentations and outside activities which are the students' favorites. Meanwhile, they could also develop students' skills by doing research and experiments so that students might start to be aware of and appreciate the environment in which they live, rather than dealing with examinations.

3. Develop Criteria for Evaluating Participation as an Alternative to Written Exams

Perhaps students would favor activities developed by teachers, such as playing games, playing drama, watching videos, involving in discussions, doing research, and engaging themselves in local environmental projects. After these activities, teachers should evaluate students' learning, provide opportunities for students' performance, and fulfill parents' expectations that their children get a good grade. Above all, teachers must strive to provide holistic and successful learning experiences for students to appreciate taking correct action as an essential key to solve environmental problems.

4. Be Sensitive to Parents' Perceptions

Although the above approach could provide a balance of developing students' research skills on their environment, and academic performance, there might be a strong challenge from parents who would be skeptical about the merits of their children's spending time in discussions and research. Nevertheless, these improvements of fostering collaboration, critical thinking, awareness, and positive attitudes toward the environment would enrich a vital and relevant education and demonstrate that teachers and parents can work together to the benefit of children in the long run.

Suggestions for Further Research

This exploration of experiences of elementary school teachers in implementing environmental education in classes has generated a number of topics for follow-up studies.

1. The participant sample of this study is small, limited to ten teachers in Taipei, a highly urbanized and metropolitanized city and ten teachers in BC in a city where has a population of 313,000. To further delineate cultural influences, it would be worthwhile to determine whether the learning outcomes in global environmental education provided by the small participant sample of this study are mirrored generally by elementary teachers across Taiwan. In order for an in-depth study to occur, a larger sample of target teachers, including several counties and metropolitanized cities, would need to be studied, and might provide quantitative evidence as well. A research design using several questions, such as "How do you rate the influences of families, communities, school authorities, government policy experts and national organizations in implementing global environmental education? And why?", might contribute a broader spectrum of specific strategies to help students incorporate an environmental ethic, and provide a clearer picture about culturally appropriate strategies in global environmental education.

2. This study gathered data exclusively from urban elementary school teachers. However, on examination of the British Columbia Ministry of Education's document *Environmental Concepts in the classroom* (1995) the emphasis on

direct experience and aesthetic appreciation with the natural environment is less important in Taiwanese teachers' perceptions than in that of British Columbia teachers. Further investigation from the perspective of Taiwanese rural school teachers is needed. The data collected might identify differences in perception with a view to developing a clearer understanding of the implementation of environmental education in urban and rural schools.

3. This study of different cultures reveals that culture is the most important determinant of the differences in the implementation of environmental education. A theory is then formulated that in the Taiwanese culture, there is need to use specific strategies, such as a government initiated an environmental policy, to help students incorporate an environmental ethic. Confucian-heritage cultures, such as these in China, Taiwan, Singapore, Hong Kong, Japan and Korea, have certain beliefs and values in common that relate to education (Ho, 1991). Children in these cultures are not as free as children in Canada to choose to do things. More parental control and pressure to succeed exist there. Obedience is a ubiquitous concept. Thus, a question for future research is raised. Do the countries of the Confucian-heritage cultures regard students' taking environmental actions in their communities to be significant? If the answer is "Yes", have their environments been improved? Another question for future research is: what environmental strategies are efficient and valid in the Confucian-heritage cultures? It might bring research

and social reality to an interesting confrontation, and provide a new impetus to global and local environmental education.

Conclusion

I hope that this study has made a small contribution to our understanding about cultural determinants of learning outcomes in global environmental education between British Columbia and Taiwan. In the beginning of this study, I explored the implementation of global environmental education with Taiwanese elementary school teachers. I wondered whether BC teachers encountered similar obstacles to those encountered by Taiwanese teachers. At this point the distinction between the global perspective and a more local environmental education became apparent. I designed the BC questionnaire around that perspective because global environmental education is deferred to a more advanced level in BC. After analyzing the BC teachers' responses, I found that BC teachers emphasized direct experience in their teaching, and helped students to take actions to improve the local natural environment as a practical way to reduce global environmental problems. This difference in teaching strategies reflects a cultural difference that must be addressed in considering appropriate approaches to education on global environmental issues in Taiwan. Later, the study examined the cultural determinants to global environmental education.

The appendices in this study, including copies of the Taiwanese elementary textbook and the events of planting trees in both cultures, might also be helpful for understanding cultural differences and their collective versus individual

emphasis. Although this small sample may not be representative of elementary teachers in general, it is hoped that using specific strategies in the Taiwanese educational system to help students incorporate an environmental ethic, might stimulate teachers' increased awareness of developing a global environmental perspective in the local level and a realization of the value of teachers' crucial roles in the implementation of environmental education.

I also hope that this study demonstrates the need for collaboration among the Ministry of Education, schools and teachers in both British Columbia and Taiwan in the implementation of environmental education. This study has pointed to the need for more support in environmental education for teachers with the goal that students could be encouraged to take responsible and positive actions in sustaining a healthy planet and have confidence in building a better tomorrow.

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Appendix A

Cover Letter for Taiwanese Principals

870 Kentwood Lane, Victoria, BC
CANADA V8Y 3C6
Tel & Fax: (250) 658-6107
Email: Lan@Octonet.com

March 20, 1997

Dear Principal,

As a graduate student in Education, I am researching obstacles teachers encounter in teaching environmental education at the grade six level. I would greatly appreciate your help. Your input is very valuable and the time taken to read and complete the survey is truly appreciated.

In an effort to keep this survey accurate, please:

Step 1 --- Choose two grade-six classes. Distribute the students' survey to the students after they have been taught the social studies unit, "Our Global Village".

Step 2 --- After the students' survey, distribute the teacher questionnaire to the social studies teachers who teach the chosen classes.

Please return the completed survey in the enclosed self-addressed stamped envelope by May 30, 1997.

Please note that all responses are confidential. If you have questions regarding this survey, please contact me. Again, thank you for your assistance.

Your sincerely,

(Amy) Hui-Mei Tsai
Graduate student,
Faculty of Education, University of Victoria

Enclosed

Appendix B

Global Environmental Knowledge

Taiwanese Grade Six Student Questionnaire and Answer Key

DIRECTIONS: Please do not write your name on this paper. Please carefully answer every question. Please circle the letter of your answer. If you do not know the answer to a question, please circle " I don't know".

BACKGROUND DATA: Please check any descriptions which apply to you.

Your school is in: a) Taipei City b) Suburb
Your school is : a) Public b) Private
Your gender is : a) Male b) Female

Please indicate your answer.

1. Acid rain has a PH of less than 5.6 a) true b) false c) I don't know.

2. What pollutants contribute to the greenhouse effect? a) carbon dioxide b) chlorofluorocarbons (CFCs) c) ozone d) nitrous oxide e) all answers f) I don't know.

3. If the greenhouse effect occurs, what would be the incorrect results? a) the North Pole would melt b) the world's oceans would rise c) the Earth's surface would rise d) the Earth would get warmer e) many cities and homes would flood f) the planet's forests would disappear g) many animals would become extinct. h) I don't know.

4. A Pollution Standards Index reading of 101 to 199 indicates air quality is: a) poor b) very poor c) harmful d) all answers e) I don't know.

5. What part of the environment is damaged when we use air conditioners and aerosol spray cans? a) forest resource b) land resource c) water resource d) the ozone layer e) all answers f) I don't know.

6. When fossil fuels burn, chemicals are released and mix with the air; causing: a) fog b) lightning c) acid rain d) hailstones e) all answers f) I don't know.

7. What part of the sun's rays damages the ecosystem? a) infrared light b) ultraviolet light c) laser rays d) all answers e) I don't know.

8. Which of the following act as "the lungs of cities"? a) factories b) automobiles c) environmentally protected parks d) all answers e) I don't know.

9. Where is the highest concentration of ozone reached? a) the Earth's surface b) outer space c) between 20 and 30 kilometers above the Earth's surface d) I don't know.

10. In order to avoid global warming, we could damage the atmosphere and let the heat escape to outer space. a) true b) false c) I don't know.

11. Acid rain produced by some countries would affect other countries? a) true b) false c) I don't know.

THANK YOU !

Answer Key:

(a) 1. Acid rain has a PH of less than 5.6 a) true b) false c) I don't know.

(e) 2. What pollutants contribute to the greenhouse effect?
a) carbon dioxide b) chlorofluorocarbons (CFCs) c) ozone
d) nitrous oxide e) all answers f) I don't know.

(c) 3. If the greenhouse effect occurs, what would be the incorrect results?
a) the North Pole would melt b) the world's oceans would rise
c) the Earth's surface would rise d) the Earth would get warmer
e) many cities and homes would flood f) the planet's forests would disappear
g) many animals would become extinct. h) I don't know.

(b) 4. A Pollution Standards Index reading of 101 to 199 indicates air quality is:
a) poor b) very poor c) harmful d) all answers e) I don't know.

(d) 5. What part of the environment is damaged when we use air conditioners and aerosol spray cans?
a) forest resource b) land resource c) water resource d) the ozone layer
e) all answers f) I don't know.

(c) 6. When fossil fuels burn, chemicals are released and mix with the air; causing:
a) fog b) lightning c) acid rain d) hailstones e) all answers f) I don't know.

(b) 7. What part of the sun's rays damages the ecosystem?
a) infrared light b) ultraviolet light c) laser rays d) all answers e) I don't know.

(c) 8. Which of the following act as "the lungs of cities"?
a) factories b) automobiles c) environmentally protected parks
d) all answers e) I don't know.

(c) 9. Where is the highest concentration of ozone reached?
a) the Earth's surface b) outer space
c) between 20 and 30 kilometers above the Earth's surface d) I don't know.

(b) 10. In order to avoid global warming, we could damage the atmosphere and let the heat escape to outer space.
a) true b) false c) I don't know.

(a) 11. Acid rain produced by some countries would affect other countries?
a) true b) false c) I don't know.

Appendix C

Global Environmental Education

Teacher Questionnaire

DIRECTIONS: Please fill in the box that corresponds to your response and indicate your answer. Your answers will remain confidential.

Please complete and return in the enclosed self-addressed stamped envelope by May 30, 1997. Send completed questionnaire to Hui-Mei Tsai.

BACKGROUND DATA

Check any descriptions which apply to you, and indicate your answer.

Your teaching school is in: ☐ **Taipei City** ☐ **Suburb**
Your gender is : ☐ **Male** ☐ **Female**
Your age is : _____
Years of your teaching career : _____ **years.**

The following survey deals with global environmental education in the Taiwanese elementary schools. It is divided into three sections. Generally, Section A asks about textbook and your instructions; Section B, what you do, and Section C, what you think. Please fill in the box and indicate your answer.

SECTION A : Textbook and Instruction Variables

Questions 1 to 11 request information about your textbook and your instructions. The questions indicated by ~~ were asked of grade six students. Please indicate whether you have taught this material and, if so, what method you used.

1. ~~ Acid rain has a PH of less than 5.6 a) true b) false c) I don't know.

☐**a. not taught. Because**_____

☐**b. have taught during grade** ___ ☐**first term** ☐**second term**
☐**Social Studies**
☐**other subject :**_____
☐**outdoor activities**
using ☐**textbook (name:**_____**)**
☐**complementary print materials (name:**_____**)**
☐**video (name:**_____**)**
☐**slide (name:**_____**)**
☐**transparency (name:**_____**)**
☐**chart (name:**_____**)**
☐**blackboard and chalk**
☐**other:**_____

☐**c. Please comment.**

_____

_____

2. ~~ What pollutants contribute to the greenhouse effect? a) carbon dioxide
b) chlorofluorocarbons (CFCs) c) ozone d) nitrous oxide
e) all answers f) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ____ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

3. ~~ If the greenhouse effect occurs, what would be the incorrect results?
a) the North Pole would melt b) the world's oceans would rise
c) the Earth's surface would rise d) the Earth would get warmer
e) many cities and homes would flood f) the planet's forests would disappear.
g) many animals would become extinct. h) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ____ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

4. ~~ A Pollution Standards Index reading of 101 to 199 indicates air quality is:
a) poor b) very poor c) harmful d) all answers e) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ___ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

5. ~~ What part of the environment is damaged when we use air conditioners and aerosol spray cans?
a) forest resource b) land resource c) water resource
d) the ozone layer e) all answers f) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ___ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

6. ~~ When fossil fuels burn, chemicals are released and mix with the air; causing:
a) fog b) lightning c) acid rain d) hailstones e) all answers f) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ____ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

7. ~~ What part of the sun's rays damages the ecosystem?
a) infrared light b) ultraviolet light c) laser rays
d) all answers e) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ____ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

8. ~~ Which of the following act as " the lungs of cities" ? a) factories b) automobiles c) environmentally protected parks d) all answers e) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ___ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

9. ~~ Where is the highest concentration of ozone reached? a) the Earth's surface b) outer space c) between 20 and 30 kilometers above the Earth's surface d) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ___ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

10. ~~ In order to avoid global warming, we could damage the atmosphere and let the heat escape to outer space. a) true b) false c) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ____ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

11. ~~ Acid rain produced by some countries would affect other countries?
a) true b) false c) I don't know.

☐a. not taught. Because_____

☐b. have taught during grade ____ ☐first term ☐second term
☐Social Studies
☐other subject :_____
☐outdoor activities
using ☐textbook (name:_____**)**
☐complementary print materials (name:_____**)**
☐video (name:_____**)**
☐slide (name:_____**)**
☐transparency (name:_____**)**
☐chart (name:_____**)**
☐blackboard and chalk
☐other:_____

☐c. Please comment.

_____

_____

SECTION B: Classroom Instruction Variables

Question 12 to 22 request that you indicate what you did with the teaching of global environmental education in the classroom.

12. Approximately how much time did you spend teaching the class about this unit?
"Our Global Village" Unit

Introductory Lesson: The causes of global village ____hour ____minutes.
Inductive Lesson 1: Rapid growth of the world population ____hour ____minutes.
Lesson 2: Rapid development and misuse of technology ____hour ____minutes.
Lesson 3: The imbalance of ecological environment — (Part 1) misuse of resources ____hour ____minutes.
Lesson 4: The imbalance of ecological environment — (Part 2) environmental pollution:
Ozone Depletion ____ hour ____minutes.
Changes of the Earth's Climate ____ hour ____minutes.
The Disaster of Acid Rain ____ hour ____minutes.
Lesson 5: What ideas people should have to solve global village' problems ____ hour ____minutes.
Culminating Lesson: Creating the ideal global village ____ hour ____minutes.

Please commend on the lesson time allocated: _____

_____

_____

13. Do you think that the time that you used for teaching this unit, such as ozone depletion, the disaster of acid rain, and global warming, is sufficient for your teaching?
(Note: range from 1 to 5 in which 1 is critically insufficient, and 5 is more than sufficient.)

Critically insufficient	Insufficient	Acceptable	Sufficient	More than sufficient
1	2	3	4	5
☐	☐	☐	☐	☐

Because _____

_____

14. How many homework assignments of this unit did you design for the students?

☐1 ☐2 ☐3 ☐4 ☐5 ☐other (Please specify) _____

Type: ☐ **Essay questions** ☐ **Collecting information, such as** _____

☐ **Other (Please specify)** _____

15. How many tests of this unit did the students take?

(1) **Quiz :** ____.
(2) **Test, such as midterm and final test:** _____.

16. Do you routinely embellish your points of this unit with examples of current issues in the class?

☐ **No, because** _____
☐ **Yes, such as** _____

17. Was the class encouraged to daily read newspapers, and watch TV news?

☐ **No, because** _____
☐ **Yes, such as** _____

18. If the students are unaware of news, will this make it difficult for them to understand what you teach about this unit?

☐ **No, because** _____
☐ **Yes, such as** _____

19. If the students lack knowledge of world geography, will this make it difficult for them to learn when you introduce international issues, such as burning rain forest?

☐ **No, because** _____
☐ **Yes, such as** _____

20. If the students lack knowledge of ecosystems, will this make it difficult for them to learn when you introduce about ozone depletion, acid rain and global warming?

☐ **No, because** _____
☐ **Yes, such as** _____

21. Did the impacts of the school , such as human resources, local environment and environmental activities, influence your instructing this unit?

☐ **No, because** _____
☐ **Yes, such as** _____

22. How do you rate the students' interest and engagement in this unit?

Poor	**So-so**	**Good**	**Excellent**
1	**2**	**3**	**4**
☐	☐	☐	☐

Because _____

_____

SECTION C: Teachers' Thoughts and Feelings

Questions 23 to 29 request that you share your thoughts and feelings about instructing global environmental education and your preparedness.

23. How important do you think teaching issues such as ozone depletion and global warming is in the elementary school?

Very unimportant	Unimportant	So-so	Important	Very important
1	2	3	4	5
☐	☐	☐	☐	☐

Because _____

_____

24. Did you find that preparation for those lessons difficult?

I don't know	No difficulties	A few difficulties	Some difficulties	Many difficulties
0	1	2	3	4
☐	☐	☐	☐	☐

Because _____

_____

25. Which resources were helpful for you when you prepared for those lessons?

☐**Newspapers. Name** _____, **because** _____
☐**TV. Program Name** _____, **because** _____
☐**Magazine. Name** _____, **because** _____
☐**Teacher's guide. Because** _____
☐**References. Name** _____, **because** _____
☐**Other, such as** _____, **because** _____

26. Which teaching methods do you find most useful in environmental issues?

☐**Lecture, because** _____

☐**Other (please specify)**_____

Because _____

_____

27. Were there any difficulties during your teaching of this unit?

I don't know	No difficulties	A few difficulties	Some difficulties	Many difficulties
0	1	2	3	4
☐	☐	☐	☐	☐

Because _____

_____

28. Do you think that enriching students' global environmental knowledge is useful for improving their environmental activities?

I don't know	Useless	So-so	Useful	Very useful
0	1	2	3	4
☐	☐	☐	☐	☐

Because _____

_____

29. Do you think that there would be different test results of this unit between urban and rural students?

I don't know	Not different	Somewhat different	Very different
0	1	2	3
☐	☐	☐	☐

Because _____

_____

THANK YOU !

Appendix D

Global Environmental Knowledge

Taiwanese Grade Six Student Questionnaire (in Chinese)

環保常識測驗

請打圈在正確答案的英文字母。本問卷不計分，也無須註明你的姓名；因此，敬請確實回答！

你的學校在：　a）台北市　　b）台北縣　　c）其他縣市。
你的性別是：　a）男　　b）女。
你的年級及班級：　a）六年級　　（　　）班。

1　酸雨的酸鹼值（PH）小於5.6。　　a）對　b）不對　c）不知道。

2　那些空氣污染物是造成地球溫室效應的元凶？　a）二氧化碳　　b）氟氯碳化物
c）臭氧　　d）氮氧化物　　e）以上皆對　　f）不知道。

3　下列何者錯誤？　溫室效應會造成下列那種現象？　a）北極冰山溶解　b）海平面升高
c）地表隆起　　d）地球溫度升高　　e）淹沒我們居住的大地　　f）森林消失
g）動物絕種　　h）不知道答案。

4　當“空氣指標值（PSI）”在　101－199　時，代表空氣品質如何？
a）不良　　b）非常不良　　c）有害　　d）以上皆對　　e）不知道答案。

5　使用冷氣機、清潔用噴霧劑，會造成下列那一種環境資源的破壞？　　a）森林資源
b）土地資源　　c）水資源　　d）臭氧層　　e）以上皆對　　f）不知道答案。

6　人類大量使用煤、石油等燃料所產生的廢氣被雲、霧等吸收，會產生下列何種自然現象？
a）濃霧　　b）閃電　　c）酸雨　　d）冰雹　　e）以上皆對　　f）不知道。

7　陽光中含有什麼射線會破壞生態平衡？　　a）紅外線　　b）紫外線　　c）雷射線
d）以上皆對　　e）不知道答案。

8　下列那一個設施又被稱做“都市之肺”？　　a）工廠　b）汽機車　c）環保公園
d）以上皆對　　e）不知道答案。

9　臭氧層在那個區域濃度最高？　a）地球的地平面　　b）太空中
c）離平面20至30公里的大氣中　　d）不知道答案。

10　爲了防止地球暖化，我們可以破壞大氣層，讓熱量散發至太空。
a）對　　b）不對　　c）不知道。

11　一國造成的酸雨會不會影響到其他國家的環境？　a）會　b）不會　c）不知道。

感謝你的回答，祝　畢業愉快！

Appendix E

Global Environmental Education

Teacher Questionnaire (in Chinese)

敬愛的　老師尊鑒:

您好！敬請於 貴校六年級學生研習社會科單元“我們的地球村”畢，填寫本問卷調查表。敬請　打鉤於適當答案的方格，及填寫有關說明。由於本問卷是以不記名的方式，敬請暢懷抒發高見；您的作答將列入保密。懇請　不吝指教，惠予協助。敬請於填寫畢，放入敝人已備妥且附郵票的信封袋，今年（１９９７）五月底之前寄至加拿大敝人寒舍。謹此，敬致 十二萬分的謝忱。

您任教的學校在: □台北市　□台北縣　□其他縣市

您的性別: □男　□女

您的年齡: _____歲

您擔任教師的年資: _____年

壹、授課 & 學生問卷調查的內容

第一題至第十一題請教您有關 貴學生問卷調查內容及您的授課方式，
“#”記號代表學生問卷調查的題目。

\# 酸雨的酸鹼值（PH）小於5.6。a）對　b）不對　c）不知道

1 □沒講解過。因為________________

□已講解過。在____年級　□上學期　□下學期

使用教科書: □社會科　□自然科　□其他科目。例如: ________科

使用教學媒體: □錄影帶。名稱: ________________

□幻燈片。名稱: ________________

□投影片。名稱: ________________

□圖表。名稱: ________________

□黑板粉筆。註明: ________________

□模型。名稱: ________________

□其他。例如: ________________

使用補充教材: 例如: ________________

利用課外活動: 例如: ________________

敬請　補充說明（例如: 對此“酸鹼值”列入教材的意見；或是———）

____

____

____

____

\# 那些空氣污染物是造成地球溫室效應的元凶？ a）二氧化碳　b）氟氯碳化物　c）臭氧　d）氮氧化物　e）以上皆對　f）不知道

2　□没講解過。因爲＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□已講解過。在＿＿年級　□上學期　□下學期

使用教科書：□社會科　□自然科　□其他科目。例如：＿＿＿＿＿科

使用教學媒體：□錄影帶。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□幻燈片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□投影片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□圖表。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□黑板粉筆。註明：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□模型。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□其他。例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

使用補充教材：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

利用課外活動：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

敬請　補充説明（例如：對此“污染物”列入教材的意見；或是———）

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

\# 下列何者錯誤？　溫室效應會造成下列那種現象？ a）北極冰山溶解　b）海平面升高　c）地表隆起　d）地球溫度升高　e）淹没我們居住的大地　f）森林消失　g）動物絕種　h）不知道答案

3、□没講解過。因爲＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□已講解過。在＿＿年級　□上學期　□下學期

使用教科書：□社會科　□自然科　□其他科目。例如：＿＿＿＿＿科

使用教學媒體：□錄影帶。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□幻燈片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□投影片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□圖表。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□黑板粉筆。註明：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□模型。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□其他。例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

使用補充教材：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

利用課外活動：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

敬請　補充説明（例如：對此“溫室效應現象”列入教材的意見；或是———）

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

當"空氣指標値（PSI）"在 101－199 時，代表空氣品質如何？a）不良 b）非常不良 c）有害 d）以上皆對 e）不知道答案

4、□没講解過。因爲＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□已講解過。在＿＿年級 □上學期 □下學期

使用教科書：□社會科 □自然科 □其他科目。例如：＿＿＿＿科

使用教學媒體：□錄影帶。名稱：＿＿＿＿＿＿＿＿＿＿

□幻燈片。名稱：＿＿＿＿＿＿＿＿＿＿

□投影片。名稱：＿＿＿＿＿＿＿＿＿＿

□圖表。名稱：＿＿＿＿＿＿＿＿＿＿

□黑板粉筆。註明：＿＿＿＿＿＿＿＿＿＿

□模型。名稱：＿＿＿＿＿＿＿＿＿＿

□其他。例如：＿＿＿＿＿＿＿＿＿＿

使用補充教材：例如：＿＿＿＿＿＿＿＿＿＿

利用課外活動：例如：＿＿＿＿＿＿＿＿＿＿

敬請 補充説明（例如：對此"空氣指標値"列入教材的意見；或是———）

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

使用冷氣機、清潔用噴霧劑，會造成下列那一種環境資源的破壞？ a）森林資源 b）土地資源 c）水資源 d）臭氧層 e）以上皆對 f）不知道答案

5、□没講解過。因爲＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

□已講解過。在＿＿年級 □上學期 □下學期

使用教科書：□社會科 □自然科 □其他科目。例如：＿＿＿＿科

使用教學媒體：□錄影帶。名稱：＿＿＿＿＿＿＿＿＿＿

□幻燈片。名稱：＿＿＿＿＿＿＿＿＿＿

□投影片。名稱：＿＿＿＿＿＿＿＿＿＿

□圖表。名稱：＿＿＿＿＿＿＿＿＿＿

□黑板粉筆。註明：＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿

□模型。名稱：＿＿＿＿＿＿＿＿＿＿

□其他。例如：＿＿＿＿＿＿＿＿＿＿

使用補充教材：例如：＿＿＿＿＿＿＿＿＿＿

利用課外活動：例如：＿＿＿＿＿＿＿＿＿＿

敬請 補充説明（例如：對此"冷氣機、清潔用噴霧劑"列入教材的意見；或是———）

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

人類大量使用煤、石油等燃料所產生的廢氣被雲、霧等吸收，會產生下列何種自然現象？a）濃霧　b）同雲　c）酸雨　d）冰雹　e）以上皆對　f）不知道

6、□沒講解過。因為_____

_____

□已講解過。在___年級　□上學期　□下學期
使用教科書：□社會科　□自然科　□其他科目。例如：_____科
使用教學媒體：□錄影帶。名稱：_____
□幻燈片。名稱：_____
□投影片。名稱：_____
□圖表。名稱：_____
□黑板粉筆。註明：_____
_____
□模型。名稱：_____
□其他。例如：_____
使用補充教材：例如：_____
利用課外活動：例如：_____

敬請　補充說明（例如：對此"酸雨"列入教材的意見；或是---）

_____

_____

_____

_____

_____

陽光中含有什麼射線會破壞生態平衡？a）紅外線　b）紫外線　c）雷射線　d）以上皆對　e）不知道答案

7、□沒講解過。因為_____

_____

□已講解過。在___年級　□上學期　□下學期
使用教科書：□社會科　□自然科　□其他科目。例如：_____科
使用教學媒體：□錄影帶。名稱：_____
□幻燈片。名稱：_____
□投影片。名稱：_____
□圖表。名稱：_____
□黑板粉筆。註明：_____
_____
□模型。名稱：_____
□其他。例如：_____
使用補充教材：例如：_____
利用課外活動：例如：_____

敬請　補充說明（例如：對此"紫外線"列入教材的意見；或是---）

_____

_____

_____

_____

_____

下列那一個設施又被稱做"都市之肺"？a）工廠 b）汽機車 c）環保公園 d）以上皆對 e）不知道答案

8、□沒講解過。因為_____

_____

□已講解過。在___年級 □上學期 □下學期
使用教科書：□社會科 □自然科 □其他科目。例如：_____科
使用教學媒體：□錄影帶。名稱：_____
□幻燈片。名稱：_____
□投影片。名稱：_____
□圖表。名稱：_____
□黑板粉筆。註明：_____
_____
□模型。名稱：_____
□其他。例如：_____
使用補充教材：例如：_____
利用課外活動：例如：_____

敬請 補充說明（例如：對此"都市之肺"列入教材的意見；或是---）

_____

_____

_____

_____

臭氧層在那個區域濃度最高？a）地球的地平面 b）離平面20至30公里的大氣中 c）太空中 d）不知道答案

9、□沒講解過。因為_____

_____

□已講解過。在___年級 □上學期 □下學期
使用教科書：□社會科 □自然科 □其他科目。例如：_____科
使用教學媒體：□錄影帶。名稱：_____
□幻燈片。名稱：_____
□投影片。名稱：_____
□圖表。名稱：_____
□黑板粉筆。註明：_____
_____
□模型。名稱：_____
□其他。例如：_____
使用補充教材：例如：_____
利用課外活動：例如：_____

敬請 補充說明（例如：對此"區域濃度最高"列入教材的意見；或是---）

_____

_____

_____

_____

_____

_____

爲了防止地球暖化，我們可以破壞大氣層，讓熱量散發至太空。　a）對　b）不對　c）不知道

１０、口没講解過。因爲＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口已講解過。在＿＿年級　口上學期　口下學期

使用教科書：口社會科　口自然科　口其他科目。例如：＿＿＿＿＿科

使用教學媒體：口錄影帶。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口幻燈片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口投影片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口圖表。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口黑板粉筆。註明：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口模型。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口其他。例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

使用補充教材：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

利用課外活動：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

敬請　補充説明（例如：對此“防止地球暖化”列入教材的意見；或是－－－）

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

一國造成的酸雨會不會影響到其他國家的環境？　a）會　b）不會　c）不知道

１１、口没講解過。因爲＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口已講解過。在＿＿年級　口上學期　口下學期

使用教科書：口社會科　口自然科　口其他科目。例如：＿＿＿＿＿科

使用教學媒體：口錄影帶。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口幻燈片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口投影片。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口圖表。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口黑板粉筆。註明：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口模型。名稱：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

口其他。例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

使用補充教材：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

利用課外活動：例如：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

敬請　補充説明（例如：對此“酸雨影響到其他國家”列入教材的意見；或是－－－

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

貳、授課本單元"我們的地球村"情況

第十二題至第二十二題請教您有關授課本單元"我們的地球村"的情況。

12. 您在該班授課本單元的時數: "地球村的形成"_____時_____分

"世界人口的快速增加"_____時_____分

"科技的快速發展和不當運用"_____時_____分

"生態環境失去平衡(一)--資源利用不當"_____時_____分

"生態環境失去平衡(二)--環境的汙染:臭氧層的破壞"_____時_____分

"地球氣溫的改變"_____時_____分

"酸雨的危害"_____時_____分

"解決地球村問題應有的觀念"_____時_____分

"創造美好的地球村"_____時_____分

請問您: 以上時數爲何如此分配? 因爲_____

_____

13. 您覺得授課本單元(如:臭氧層,酸雨,溫室效應)的時數是否足夠 ?

口非常足夠 口足夠 口不知道 口不足 口非常不足 口其他.如:_____

因爲_____

_____

14. 您曾在該班於本單元安排家庭作業_____次:方式-口問答題口剪貼報章雜誌口其他.如:_____

15. 您曾安排在該班有關本單元小考_____次.大考(如:期考,月考..)_____次.

16. 您曾在該班授課本單元時,舉例說明過.

口沒有.因爲_____

_____

口有.例如:_____

_____

17. 該班平日有鼓勵每天閱讀報紙時事,收視電視新聞的措施嗎?

口沒有.因爲_____

_____

口有.例如:_____

18. 若小學生尚未養成看報,關心時事的習慣,您在授課本單元會有困難嗎?

□沒有.因爲_____

_____

□有.例如:_____

_____

19. 由於小學生尚未上過有關世界各國地理課程,如果您介紹有關某外國發生焚燒熱帶雨林等實例,學生在認知上會有困難嗎?

□沒有困難 □有困難 因爲_____

_____

20. 由於小學生尚未上過有關科學課程,您在介紹臭氧層,酸雨,溫室效應等,學生有困難嗎?

□沒有.因爲_____

_____

□有.例如:_____

_____

21. 貴校地緣關係(如:人力資源是否充分配合,當地環境是否被污染,環保措施或設施是否完善..等)是否對您的授課本單元有所影響?

□沒有.因爲_____

_____

□有影響.例如:_____

_____

22. 該班上本單元(如:酸雨,臭氧層,溫室效應)是否有興趣?

□沒興趣 □不知道 □有些興趣 □很有興趣 □其他.如:_____

因爲_____

參、授課本單元"我們的地球村"感想與心得

第二十三題至第二十九題請教您有關授課本單元"我們的地球村"的感想與心得。

23. 您覺得本單元(如:臭氧層,酸雨,溫室效應)對小學生是否重要 ?

□不重要 □不很重要 □普通 □重要 □很重要 □非常重要

因爲_____

24. 您覺得授課本單元前的準備教材工作有困難嗎 ？

□非常困難 □很困難 □還好 □不困難 □完全沒有困難

因爲_____

25. 在準備本單元教材時,您覺得哪些資料獲益良多 ？

□報紙.名稱:_____.因爲_____

□電視.節目名稱:_____.因爲_____

□雜誌.名稱:_____.因爲_____

□教師手冊.因爲 _____

□參考書.書名:_____

因爲_____

□其他.例如:_____

因爲_____

26. 您覺得授課本單元(如:臭氧層,酸雨,溫室效應)時,採用何種方式最佳 ？

□講述法.因爲_____

□其他.例如:_____

因爲_____

27. 您覺得授課本單元(如:臭氧層的破壞,地球氣溫的改變,酸雨的危害)有困難嗎 ？

□非常有困難 □有些困難 □有一點點困難 □沒有困難 □完全沒有困難

因爲_____

_____

28. 您覺得小學生的瞭解本單元(如:臭氧層的破壞,地球氣溫的改變,酸雨的危害)有助於他(她)們的環保行爲嗎?

□非常有幫助 □有些幫助 □不知道 □沒有幫助 □其他.如:_____

因爲_____

_____

29. 您覺得市區小學生和非市區小學生於本單元的考試成績會有差異嗎 ？

□沒有差異 □不知道 □會有一些差異 □會有很大差異 □其他 .如:_____

因爲_____

_____

Appendix F

Cover Letter for British Columbia Teachers

(Amy) Hui-Mei Tsai
870 Kentwood Lane
Victoria BC V8Y 3C6
phone : (250) 658-6107
fax : (250) 658-6107
e-mail : Lan@Octonet.com

March 20 , 1998

Dear Teacher,

As part of the requirements for my Masters from the University of Victoria, I will be conducting a study of teachers' experiences of teaching environmental education at the grade six level.

I would greatly appreciate interviewing you regarding your experiences. The interview will take less than one hour. I enclose the questions I will ask, and a consent form.
I will be pleased to share with you the results of my research. Your input into this study is important. I would appreciate the opportunity to meet with you. I will call to set up an appointment and I look forward to meeting with you at that time.

Thank you in advance for your participation in this study. If you have questions, please feel free to call me any time.

Sincerely,

Tsai Hui-Mei

Appendix G

Cover Letter for Taiwanese Teachers

Dear Teacher,

As part of the requirements for my Masters from the University of Victoria, I will be conducting a study of teachers' experiences of teaching environmental education at the grade six level.

I would greatly appreciate your completing the questionnaire regarding your experiences. The questionnaire will take less than one hour. I enclose the questions I will ask, and a consent form. I will be pleased to share with you the results of my research. Your input into this study is important. I would appreciate the opportunity to receive your completed questionnaire and consent form that you fax me before the end of March. I will mail the fax fee to you and thank you for your assistance.

Thank you in advance for your participation in this study. If you have questions, please feel free to contact me any time, or call my best friend Ju-Poan Young (a teacher of Jan Chan Middle School in Taipei City) at (02)7356043 (home) or (02)5313249 (school).

Thank you for your assistance and best wishes for a rewarding '97-'98 school year.

Sincerely,

Tsai Hui-Mei

870 Kentwood Lane
Victoria BC V8Y 3C6
phone : (250) 658-6107
fax : (250) 658-6107
email : Lan@Octonet.com

Appendix H

Cover Letter for Taiwanese Teachers (in Chinese)

敬愛的 老師 尊鑑:

敝人目前就讀於加拿大英屬哥倫比亞省維多利亞大學,所研究的論文是有關社會科教師指導國小六年級學生環境教育的教學經驗.殷切需要您的寶貴教學經驗及意見,謹此懇請您的協助.

由於遙隔大洋,未克當面晤談.敝人謹此附上問卷及同意書各一份,將勞駕您四十分鐘填寫,敬請撥冗鑑覆,且懇請於三月底前傳眞此兩份資料予敝人(傳眞號碼:002-1-250-6586107);或逕寄至台北市華陰街34號建成國中楊玉盤.敝人將一併寄上工本費及傳眞費,不情之請,尚祈見諒.

您惠予提供的寶貴教學經驗,將使此研究報告更臻完善.敝人亦將竭盡所能,回函分享此研究成果.若您有任何疑問,請隨時電洽敝人,若不便傳眞,則電洽吾至友楊玉盤〔建成國中(02)559-6842-21,住宅(02)735-6043〕.再次感謝您的配合及協助.敬祝 鈞安

新春愉快　萬事如意

蔡惠美敬上 98 年 2 月 28 日於加拿大維多利亞

(Amy) Hui-Mei Tsai
870 Kentwood Lane, Victoria,
B.C. V8Y 3C6
Canada
phone & fax: (250)6586107
email : Lan@Octonet.com

Appendix I

Consent Form for British Columbia Teachers

THE UNIVERSITY OF VICTORIA
HUMAN RESEARCH ETHICS COMMITTEE

CONSENT FORM FOR PARTICIPANTS IN THE STUDY ENTITLED,
" OBSTACLES AND EFFECTIVENESS OF
TEACHING ENVIRONMENTAL EDUCATION "

I understand that this research project is a study of teachers' experiences of teaching environmental education. I understand that I will be asked about my impressions, opinions and experiences of the program in an interview, guided by Tsai Hui-Mei. Hui-mei 's objective is to explore the obstacles and effectiveness of teaching environmental education and to provide guidelines for the future.

I understand that my participation is completely voluntary and that I can withdraw from the study at any time, without explanation.

I understand that any data collected in the study will remain confidential and that interview results and surveys will be kept in a locked filing cabinet. Furthermore, I understand that my name will not be attached to any published results, and that my anonymity will be protected by using pseudonyms to identify the results obtained from individual subjects.

I understand that my interview will be audio-taped and that the tape will be erased immediately after the experiences that I talk about are transcribed by Hui-Mei and verified for accuracy by me. I also understand that if I do not wish to have my interview taped, I can refuse to do so.

I understand that whether I participate or choose not to participate will have no bearing on my employment status and that my employer will not have access to any of the information collected in this study.

Date : _____

Signature : _____

Appendix J

Consent Form for Taiwanese Teachers

THE UNIVERSITY OF VICTORIA
HUMAN RESEARCH ETHICS COMMITTEE

CONSENT FORM FOR PARTICIPANTS IN THE STUDY ENTITLED,
" OBSTACLES AND EFFECTIVENESS OF
TEACHING ENVIRONMENTAL EDUCATION "

I understand that this research project is a study of teachers' experiences of teaching environmental education. I understand that I will be asked about my impressions, opinions and experiences of the program in a questionnaire, guided by Tsai Hui-Mei. Hui-Mei 's objective is to explore the obstacles and effectiveness of teaching environmental education and to provide guidelines for the future.

I understand that my participation is completely voluntary and that I can withdraw from the study at any time, without explanation.

I understand that any data collected in the study will remain confidential and that questionnaire results and surveys will be kept in a locked filing cabinet. Furthermore, I understand that my name will not be attached to any published results, and that my anonymity will be protected by using pseudonyms to identify the results obtained from individual subjects.

I understand that my questionnaire will be erased immediately after the project is finished.

I understand that whether I participate or choose not to participate will have no bearing on my employment status and that my employer will not have access to any of the information collected in this study.

Date : _____

Signature : _____

Appendix K

Consent Form for Taiwanese Teachers (in Chinese)

加拿大英屬哥倫比亞省維多利亞大學人類調查道德委員會

提供有關 "指導學生環境教育所面臨的障礙或萌發有效率的教學法" 教學經驗的個人同意書

我瞭解此研究調查是彙整有關教師們指導學生環境教育的經驗談.我也瞭解我將於問卷中提供我個人有關環境教育的教學經驗及看法.此問卷題目是由蔡惠美針對調查教師們指導學生環境教育所面臨的障礙或萌發有效率的教學法而設計,以便對往後的教學有所裨益.

我瞭解我的提供教學經驗是完全出自我個人意願.我也可以隨時撤銷我的提供,且無需任何理由.

我瞭解此問卷調查有關我的個人資料將完全保密,我的姓名將不被發表於此調查公開文件上,並且我的姓名將受到保護而以別號替代,且於報告完成後將被銷毀.

我瞭解在此調查完成後,基於保密起見,我的問卷將被銷毀.

我瞭解我決定答覆或不答覆此問卷調查,將不致影響我的職業的去留.我的上司也無法由此調查中取得我所提供的資料.

填寫同意書的日期:_____

簽名:_____

Appendix L

Environmental Education Teacher Questionnaire

INTERVIEW QUESTIONS

1. Approximately how much time do you allot to teaching environmental education in a year ?

2. The draft IRP for grade six has at least three prescribed learning outcomes related to environmental concerns. These are highlighted on the excerpts attached.
   In teaching environmental issues to grade six, is your primary goal(s) to impart knowledge, to teach skills or to develop positive attitudes toward the environment ?
   Please comment on why you emphasize the goal(s) you have chosen.

3. What do you think influences the time teachers allot to study of the environment in grade six ?

4. What obstacles or difficulties have you personally experienced in teaching grade six students environmental education ?

5. What strategies have you found to be most effective in teaching environmental education ?

6. Other comments would be appreciated.

Appendix M

A Sample of British Columbia Social Studies

K to 7 Integrated Resource Package

Described Learning Outcomes for Social Studies Grades K-11

Grade 6

Applications of Social Studies
- identify and clarify a problem, issue, or inquiry
- demonstrate an ability to research information using print, non-print, and electronic sources
- evaluate the credibility and reliability of varied sources
- organize information from a variety of sources into a structured presentation using more than one form of representation
- support a position on a national issue by considering competing reasons from various perspectives
- design, implement, and assess detailed courses of action to address national problems or issues

Society and Culture
- describe ways social and economic organizations satisfy needs and wants in a variety of cultures
- assess the relationship between cultures and their environments
- describe daily life, work, family structures, and gender roles in Canada and the world
- analyse how a society's artistic expression reflects its culture
- demonstrate an appreciation of the contributions of a variety of cultures to Canada and the world

Politics and Law
- compare individual rights and social responsibilities in various cultures
- compare systems of government in selected countries
- demonstrate an understanding of global citizenship
- demonstrate an awareness of United Nations' human rights initiatives

Economy and Technology
- describe and compare different economic systems
- describe Canada's changing economic relationship with Pacific Rim countries
- assess the effects of urbanization and technology on lifestyles and environments
- evaluate mass media stereotypes of cultural groups or geographic regions

Environment
- interpret and use graphs, tables, aerial photos, scales, legends, and various types of maps
- identify the relationship between time zones and lines of longitude
- locate and describe major geographic features and selected nation states of the world
- assess settlement patterns and population distribution in selected countries
- relate population growth and settlement patterns to resource consumption and depletion in selected countries
- compare use of resources and conservation practices in Canada and other countries

BRITISH COLUMBIA
Ministry of Education
Skills & Training

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PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- demonstrate an ability to research information using current technology
- evaluate the credibility and reliability of varied sources
- organize information from a variety of sources into a structured presentation using more than one form of representation
- support a position on a national issue by considering competing reasons from various perspectives
- design, implement, and assess detailed courses of action to address national problems or issues

SUGGESTED INSTRUCTIONAL STRATEGIES

Students use a variety of technologies to research information and share their observations in small groups. They assess bias and the context of various points of view.

- Challenge students to use four different technologies (e.g., phone, fax machine, CD-ROM, the Internet) to research information on a specific topic or question (e.g., Canada's Spanish-speaking neighbours in the Pacific Rim).
- Simulate a historical or controversial event and have students record their observations and interpretations. Provide opportunities for them to share their observations in small groups and to discuss why they have different perspectives (e.g., background, experience, knowledge, bias). Then ask students to read or view a documented historical event from two or more perspectives and analyse the different interpretations.
- Have students examine TV advertisements for underlying objectives and motives. Their analyses should look at claims of superiority and quality, and examine the credibility and reliability of these claims. How effectively are claims proved or substantiated? What weaknesses can be found in advertising claims?
- Have students analyse a BC river in terms of conservation and resource management. Divide the class into co-operative groups. Ask each group to report on one issue (e.g., industry by-products, erosion, fish habitats, river history). Groups also select forms of representation for their issues. Challenge groups to work together to assemble their reports into a coherent, cohesive class presentation, using an outline and a work plan.
- Ask students to design strategies to persuade Canadians to take a particular course of action (e.g., keep Canada united, reduce speeding). Then invite them to determine the feasibility of the strategies, select one, and implement it. Students can send a class letter to the editor of a local paper defending their decisions.

PRESCRIBED LEARNING OUTCOMES

It is expected that students will:

- locate and describe major geographic features and selected nation states of the world
- identify the relationship between time zones and lines of longitude
- assess settlement patterns and population distribution in selected countries
- relate population growth and settlement patterns to resource consumption and depletion in selected countries
- compare use of resources and conservation practices in Canada and other countries

SUGGESTED INSTRUCTIONAL STRATEGIES

Students study geographical features and natural systems to enhance their awareness of how a cultural landscape is shaped. Through research and debates, students gain an understanding of the causes and consequences of human settlement patterns.

- Provide students with aerial and satellite photos and have them locate topographic features (e.g., bodies of water, watershed systems) and urban settlements.
- Have students work in groups to examine relationships between urban settlement patterns and proximity to bodies of water. Encourage them to consider what human needs led to these relationships.
- Invite students to research and chart three examples of how Aboriginal people in Canada used their environment to develop their economy (e.g., building boats from cedar, constructing longhouses and igloos) Ask them to extend the chart by researching similar Aboriginal economies in other countries (e.g., Aborigines of Australia, Yanomamos of Brazil).
- Have students construct glossaries that define environmental terms associated with resource management (e.g., *sustainability, stewardship*).
- Ask students to choose one natural resource and chart how it has affected settlement, the economy, and the environment in five countries.
- Challenge students to select topics for debate, such as:
  - Jobs are more important than forests.
  - Current fisheries policies meet the needs of commercial, sport, and Aboriginal fishers.
  - Selling fresh water to the United States is a good idea.
- Introduce the concept of the *ecological footprint* (a visual metaphor for the amount of land required to produce the energy, food, and goods consumed annually by an average individual, measured in hectares). Inform students that the ecological footprint for the average Canadian is 4.8 ha and is 1.6 ha for the average world citizen. Have them compare consumption patterns in different countries.

SUGGESTED ASSESSMENT STRATEGIES

Students are encouraged to demonstrate their learning about geography, the environment, and their effects on human settlement in a variety of ways including the production of maps, models, written reports, murals, and skits. Students learn how Canadians use and manage natural resources and make comparisons to management and conservation practices in other countries.

- To assess students' debating skills and understanding of environmental issues, develop with them a list of criteria such as:
  - uses voice and physical expression to build communications
  - includes specialized vocabulary where appropriate
  - listens to opposing arguments and responds
  - presents several arguments from different perspectives
  - demonstrates in-depth understanding of the topic
- Have students research an environmental issue by writing to two sources that would provide information from different perspectives (e.g., to research clearcutting, students could write to Greenpeace and MacMillan Bloedel for information on forestry practices). Ask students to compare and contrast the information they receive. Note the extent to which they can distinguish between the two perspectives and suggest reasons why information provided by the two groups may differ.
- Invite students to work in small groups to research and compare a conservation practice (e.g., reforestation, recycling, banning the sale of ivory) in Canada with another country. Work with students to develop a list of topics to be included in their research. After completing the study, use a jigsaw approach (each member of the group joins another group and explains their research) for further discussion. Look for evidence that students understand how different countries manage conservation issues and the reasons for these differences.

RECOMMENDED LEARNING RESOURCES

Print Materials

- Bangladesh
- The Canadian Oxford School Atlas (6/e)
- Children of Peru
- China
- Christopher Columbus
- Focus on China
- Food Around the World
- Ghana
- In Japan
- Inca Civilization
- The Indian Subcontinent
- The Integrated Atlas
- Mathematics From Many Cultures
- The Maya
- The Nystrom World Atlas
- Project Learning Tree Environmental Education Activity Guide
- The Story of Canada
- Strands In The Web
- The Wayland Picture Atlas
- World Focus Series
- A World of Difference

Video

- Africa: Western Region
- Cesar's Story
- Latitude and Longitude
- Mwe Bana Bandi
- Sadako and The Thousand Paper Cranes
- Under One Sky: Children in Kenya

Appendix N

Environmental Education

Teacher Questionnaire (in Chinese)

問卷題目

1. 通常在一年當中(包括上.下學期),您在社會課程最多安排多少時間指導學生有關環境教育 ?

2. 國立編譯館出版的國小社會教師手冊中明列許多國小六年級教學目標(如附件).您認爲最主要的教學目標是哪一個(或哪些)?請說明爲何您認爲這個(或這些)教學目標很重要 ?

3. 您認爲有哪些因素影響國小六年級社會科教師指導學生環境教育的時數?

4. 依您個人的教學經驗,您認爲有哪些障礙或困難在您指導國小六年級學生有關環境教育 ?

5. 在您指導國小六年級學生有關環境教育的時候,您是否發現任何更有成效的教學法 ?

6. 請您補充說明任何有關國小六年級社會科教師於指導學生環境教育的情況.(彌補以上五個問題未周詳涵蓋之處).故請抒發暢懷爲快! 感謝您的寶貴意見.

Appendix O

A Sample of the Taiwanese Grade Six Social Studies Teacher's Guide: The Goals of Teaching (in Chinese)

參、六年級第二學期教學目標和教材綱要

單元名稱	單元目標	教材綱
二、我們的地球村（十四節）	1.了解地球村面臨的問題及其影響。 2.養成對地球村問題應有的觀念及態度。 3.發展解決問題的能力。	一、地球村的形成 ㈠原因 1.傳播工具的發展 2.交通工具的改進 ㈡結果 1.空間距離縮短

Appendix P

A Sample of the Taiwanese Grade Six Social Studies Textbook: Acid Rain (in Chinese)

的冰川也會加速融化，造成海平面上升，淹沒了沿海低窪的地區。

酸雨的危害

使用煤和石油等能源作為燃料，會排放一些含有酸性物質的廢氣，這些廢氣跟大氣層中的水蒸氣結合，降到地面上，就形成「酸雨」。

酸雨會造成植物枯萎、湖泊酸化、建築物腐蝕等危害。造成酸雨的廢氣，還會隨著氣流做長距離的移動，所以它危害的地區非常廣大，沒有國界的限制。

㉟ 酸雨會造成植物枯萎

想一想：

地球村的環境怎麼樣被汙染了？會造成哪些影響？請舉出例子來說明。

Appendix Q

An Article from *China Time*:

The Little Trees Have Grown Up (in Chinese)

The trees, planted by the Taiwanese adults six years ago on the mountains, have grown up.

(*China Time*, May 10, 1998)

茁壯

●民國八十一年參與種樹救水源活動的人士前往大甲溪上游橫流溪一塊出租林地冒雨種下三、四十公分高的樹苗（圖右），如今都已經成長為四、五公尺高的樹木（圖左）。

（呂理德攝）

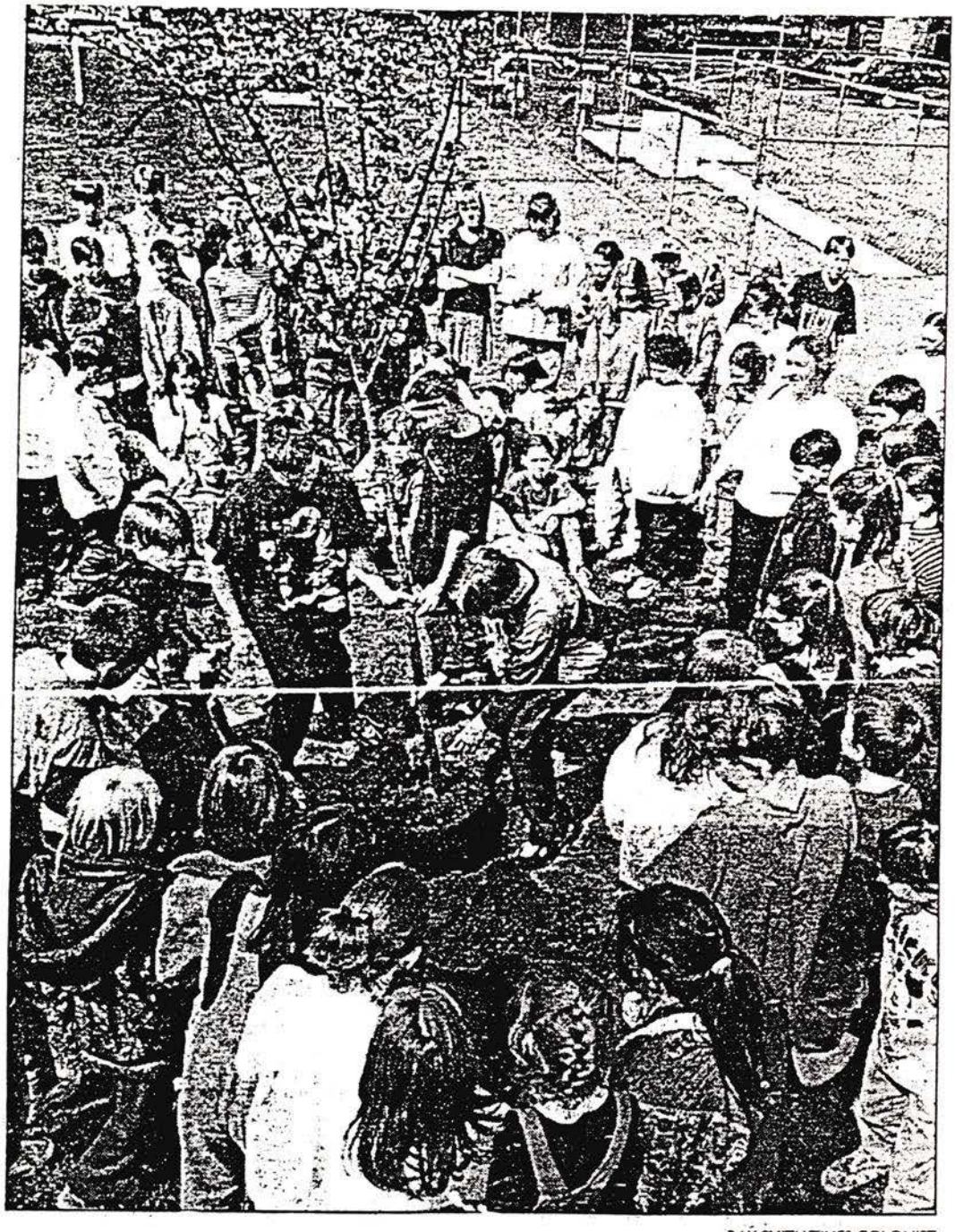
【記者呂理德台北報導】由中國時報系等單位共同推動的種樹救水源活動，自民國八十一年起展開，當年第一批種下的高約三、四十公分的小樹苗，百分之九十以上成活，如今都已成長至有四、五公尺高，蔚然成蔭，更已開始發揮涵養水源的功能。

「種二千萬棵樹救台灣水源」活動，是由環保署、教育部、農委會、林務局、中國時報系共同主辦，國語日報、中華民國自然生態保育協會、時報文教基金會、中油公司、壽山文教基金會、大甲溪生態環境維護協會、

Appendix R

An Article from the Victoria *Times Colonist*:

Happy Earth Day



RAY SMITH/TIMES COLONIST

Happy Earth Day

Students of Happy Valley Elementary School plant a Japanese ornamental plum tree to commemorate Earth Day. The students' council organized the event to mark Earth Day and start a tradition of school ground beautification.

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The Honor of Top 1 of Teaching Medium Exhibition	1990

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Author [redacted]

Hui-Mei Tsai

March 29, 1999