

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

In this chapter, related literature on environmental knowledge, awareness and attitude, which had been conducted by previous researchers both in and out of Malaysia, are reviewed.

2.2. Global Studies Pertaining to Environmental Knowledge, Awareness and Attitudes

Hsu and Roth (1996) assessed the environmental knowledge and attitudes held by community leaders in the Hualien area of Taiwan. The objectives of the study were to assess the environmental knowledge and attitudes held by the selected community leaders in the Hualien area of Taiwan and to determine the most serious local and national problems and the major source of environmental knowledge as perceived by the selected community leaders. The study also assessed the types of environmental education activities the community leaders would be willing to attend.

The items selected for the study were related to general environmental concepts and specific environmental conditions in Taiwan. The environmental conditions involved were the New Central Cross Island Highway across Yushan National Park, the Fourth Nuclear Power Plant and a large-scale cement industry.

A 55-item questionnaire was mailed to 250 randomly selected community leaders with the response rate at 70.4%.

In general, the environmental knowledge of Hualien's community leaders' was moderately high with an overall correct response rate at 75.9%. About 80% of all environmental attitude responses were positive or strongly positive. Although community leaders appeared to have high positive environmental attitudes, they were rather reluctant when personal sacrifices were required. Education level was the only variable that predicted the environmental knowledge level. On the other hand, the variables such as education level, ethnicity, occupation (communicators and elected political representatives) and age were the best predictors of environmental attitudes. Generally, education level was the most important indicator of environmental knowledge and attitudes. In the determination of both environmental knowledge and attitude scores with independent variables, the variables such as age, education level, income level or occupation and ethnicity showed significant differences. Gender did not show significant difference in environmental knowledge. Generally, in determining the relationship between community leaders' environmental knowledge and attitudes, there was a positive correlation of 0.42 ($p < .001$).

When the leaders were asked of their opinion on the three important environmental issues, answers were variable. 62.7% of the community leaders agreed or agreed strongly with the proposed construction of the New Central Cross Island Highway across Yushan National Park whereas 23.6% were against it. Approximately 54.3% of the community leaders supported the proposed

construction of the Fourth Nuclear Power Plant in northeastern Taiwan but only 17.8% of the community leaders supported the proposed construction of a large scale cement industry in the east of Taiwan. In determining the significant relationships between community leaders' responsibilities towards the three opinion items and the independent variables, a higher percentage of community leaders with higher education levels disagreed with the construction of the New Central Cross Island Highway and the Fourth Nuclear Power Plant. The leaders perceived environmental pollution and the destruction of ecosystems as the most serious local problem and difficulty in finding a job was selected as the most serious national problem. There was no significant relationship between community leaders' perception about the most serious local problem and all the independent variables. However, there seemed to have significant differences between community leaders' perception of the most serious national problem with education and income level. Leaders named the newspapers, books and magazines as the main source of environmental knowledge and attitudes compared to TV and radio. The community leaders were willing to participate in environmental education activities if they were field trips and outdoor activities (69.4%) while 47.9% of the community leaders were interested in slide shows and movies.

Petrzelka, et. al. (1996) compared the ideologies of sustainable farmers and conventional farmers. A mail survey of farmers belonging to the Practical Farmers of Iowa was examined in 1989 to determine the attitude-behavior relationship of these farmers and the role of social influences in this relationship. Attitude and social influence scales were developed as well as a chemical input

index that measured their commitment to sustainable practices. Of the 260 mailed questionnaires, 151 were used in the analysis. The dependent variable involves the chemical input index scale that measured the farmer's self-reported behavior on sources of nitrogen and practices used to control weeds and insects during the 1988 crop year. The scale ranges from no use of chemicals to a high level of chemical usage. The independent variable in the study was the farmers' attitude toward agriculture, the environment and society. A four scale attitudinal questionnaire were created to measure the respondents' attitude towards

- a) sustainable farming and community
- b) natural farming methods
- c) economic rationality
- d) conventional farming

The social factors examined for the facilitation of the attitude-behavior relationship were the degree of farmers' participation in the three organizations listed as most important to the respondents and the degree to which they used the information sources. To explore the potential impact of personal and farm operation characteristics on the use of sustainable farming practices, variables such as age, education, size of farm operation, tenure situation of the farm operation and on-farm income were examined.

Social influences examined in this study were not instrumental in affecting the attitude-behavior relationship and neither was the level of participation in sustainable or conventional organizations. The use of conventional information sources was a significant predictor of actual chemical usage regardless of

attitudes. The result of regression revealed that age, gross farm income and information sources were the best predictors of increased chemical use. The study also showed significant relationships between farm income and favorable attitudes towards economic rationality and conventional farming. Farmers with smaller gross farm incomes might view farming more as a way of life and although motivated by economic factors, they were also motivated by concerns of sustainability for agriculture and rural communities. This idea was supported by the significant inverse relationship between farm income and favorable attitudes toward sustainable farming and community. Finally the strong relationship between conventional information sources had major influence on the use of chemicals. The group of Iowa farmers examined do not appear to be lacking a sense of responsibility to the earth and the future generations. However, other factors had stronger impact on the actual farmer behavior such as information. The regression results indicated that using conventional information was significantly related to greater chemical use whereas using sustainable information was not significantly related to chemical use. The result suggested two types of educational and policy needs. First, attitude has an indirect effect through other variables such as age. Second, public policy is needed for leaders both public and private institutions supporting agricultural research and outreach to raise their awareness of the need for increased research on the agronomic and economic issues of using sustainable agriculture and dissemination of the research information.

Arcury and Christianson (1993) studied the variation in environmental knowledge and attitude between the rural and urban residents. In the study, the authors examined the differences that persist when socio-demography factors were controlled. The hypothesis made was that the more metropolitan and urban an individual's place of residence, the greater will be the individual's environmental world view, concern, knowledge and actions under controlled conditions. Interviews were conducted with 624 residents in 14 of the 39 counties in the Kentucky River Drainage Basin with the response rate at 54%. The primary independent variable in this analysis was the residence group while the dependent variables were environmental worldview, environmental concern, environmental knowledge and environmental action. The socio-demographic factors included in the analysis were age, gender, education, income and farm residence.

Without controlling the effects of socio-demographic factors, they found that metropolitan and urban respondents had stronger environmental worldviews and knowledge on global environmental problems. However, they did not differ from the non-metropolitan and rural residents in environmental concerns or environmental actions. When the socio-demographic factors were controlled, the results indicated that the relationship of rural-urban residence to environmental characteristics had little importance. But the relationship of socio-demographic factors (e.g. income, education and age) to the environmental characteristics showed significant differences in environmental characteristics between rural and urban residence group. The conclusion derived from the study reveals that the

success of environmental education depends on its participation in promoting equity in the general population.

Thompson and Gasteiger (1985) conducted an attitudinal survey among the Cornell University students in 1971 and 1981 that contrasted student perceptions on environmental or energy questions. 3,414 and 3,867 students were sampled respectively. The survey was designed to measure the changes in attitude toward 35 specific items in five major categories, which include foodstuffs, household items, transportation, personal items and recreation. The questionnaire was formulated into four parts:

Part 1 : to assess student awareness of environmental / energy problems by asking them to respond to a provocative statement on the subject

Part 2: to quantify their willingness to give up specific items

Part 3 : to focus on various possible control measures

Part 4 : to provide a profile of the respondents

The results of the two surveys indicated significant changes in attitudinal responses to environmental, material and energy resources among the Cornell University students during the 10 years span from 1971-1981. In the inter-survey data comparisons, students' reaction to the statement about our material and energy resources did not show significant difference in the mean numerical values. However, there were significantly fewer students who chose 'strongly agree' category in 1981 (37.3%) compared to 1971 (45.7%) with a tendency towards materialistic considerations and conservative approaches to environmental or energy issues. The study also indicated softening attitudes

toward environmental issues. Much of the differences in the attitudinal responses between the two surveys were influenced by political leaning, income, gender and other factors. Political leaning was statistically important for 80% of the items in 1981 and 94% in 1971 with a significant change toward less willingness to part with items despite the perceived material and resource limitation. In income level, the trend was towards an unwillingness to give up items as family income level increased. There was no distinct differences between gender, except that gender differences was strongest for personal items. Other factors such as education did not play a major role in attitudinal response on energy or resource issues for either survey. Students' enrollment in the biology and society course was not a significant factor. In contrast, there were wide differences among students from the different schools or colleges within the university with 67% of the items in 1981 and 80% of the items in 1971. These differences were observed in all five categories with the most occurring in the recreational category followed closely by transportation, foodstuffs and household items. Thus, the trend seemed to move towards a materialistic lifestyle, which reflected less consideration for environmental or energy oriented issues and concerns.

Armstrong and Impara (1991) evaluated the impact of an environmental education programme, the 'Nature Scope', conducted in a classroom setting for 8 weeks which was used as a curriculum supplement. The authors focused the evaluation on the impact of the selected 'Nature Scope' issues on participants' knowledge and attitudes concerning the environment by evaluating the relationship and comparing the environmental knowledge and attitude of students

exposed to 'Nature Scope' with those without any exposure. They also compared the knowledge and attitude between the fifth and seventh grade students. In the study, 4 out of the 17 'Nature Scope' issues were used and they were 'Let's Hear It for Herps', 'Discovering Deserts', 'Wild About Weather' and 'Endangered Species'. A knowledge test was developed for each of the 4 issues by preparing items according to a list of general concepts for each activity guide. For each of the four knowledge tests, reliability estimates were obtained from the pilot test, pretest and posttest. The same measures were used for both grades.

From the study, 85 activity packets were distributed to the teachers and the overall return rate was 56.5%. The results showed that only 'Let's Hear It for Herps' had significant positive impact on the participants' knowledge. The adjusted posttest mean of the experimental group for 'Let's Hear It for Herps' was significantly higher than the adjusted mean for the control group by 10.7%. The remaining issues did not have sufficient impact to be considered statistically significant. From the attitude score, no significant differences were found among attitude means for any of the five groups and no significant differences in attitude across the two grades. It was found that the 'Let's Hear It for Herps' issue had the highest correlation between knowledge test score and attitude scale score while the 'Endangered Species' issue had the lowest knowledge or attitude correlation. The average correlation across the four 'Nature Scope' issue was 0.46. In general, the classes exhibited positive attitudes following exposure to 'Nature Scope'.

Cohen (1973) did one of the early studies on environmental information and environmental attitudes. Cohen compared the environmental attitude of two

groups of high school students possessing different amounts of environmental information. A questionnaire containing 35 environmental information questions and 35 environmental attitude questions was administered to 454 high school students from 7 schools. Part of the scores from the environmental information section was used to separate a high environmental content group of 84 students from the 116 students of low environment content group. The attitude responses of these two groups were compared.

The results of the study indicated a significant relationship between environmental information and environmental attitude. Both groups had different attitudes towards various issues. The group with more information displayed more uniform responses and they were more willing to express their attitudes. A higher percentage of the high environmental content group chose 'agree', 'disagree', 'strongly agree' or 'strongly disagree' responses. Only 30% or more of the students selected "no comment" response for 3 out of the 35 questions. The group with less information, however, had more evenly distributed responses. Eleven out of the 35 questions had 30% or more of the 'no comment' responses. The study revealed that the willingness to express an attitude is significantly different between the two groups.

Worsley and Skrzypiec (1998) surveyed the environmental attitude of 15-18 years old students in South Australia in 1994. Students were selected from South Australia secondary schools which had been randomly selected according to the socio-economic background in which they were located. Over 1,000 students from 32 different schools were sampled. The samples were measured by using a

modified form of Herrera's (1992) Questionnaire of Environmental Beliefs. The principal environmental components analyzed include environmental concern, environmental pessimism, environmental exploitation, science solutions, environmental optimism, environmental protection and technological society. The study examined students' attitudes and beliefs towards the environment. It also compared environmental concern between genders and the possible relationship between schools' environmental curriculum and students' opinions. In addition, one of its hypothesis include the relationship between meat consumption and environment concern. Worsley and Skrzypiec presumed that student from rural and agricultural schools were more optimistic about environmental issues compared to those in urban schools.

The results revealed that around 75-90% of the students expressed concern about each of the issues questioned in the environmental concerned component. Teenage girls seemed to be more concerned about the environment than teenage boys. From the environmental pessimism survey, larger number of students agreed with the items listed about land degradation and population growth although many would not comment on the matter. They generally believed that we have to work together to change our current way of life or environmental degradation will persist and become worse. Although teenage girls tend to be more pessimistic, basically, there were no statistical significance between teenage boys and girls. In the environmental exploitation component examination, the results were paralleled with the hypothesis. Many students agreed that the environment should not be exploited. It also showed that students in high SES areas were more

concern about the exploitation of the environment for current need compared to the low SES students. The greatest support for environmental exploitation was also expressed by students in the state girls' school while the private girls and co-educational country schools showed least support to this notion. Generally, students were against the role of science and technology in solving environmental problems. Teenage girls perceived science and technology more negatively compared to teenage boys.

From the environmental protection issues survey, it indicated a positive note when an environmental protection issue surpassed other economic growth or legislation issues. Overall, there was no significant sex difference despite that teenage boys tended to be less enthusiastic about most of the proposals listed.

In the last section of the questionnaire, students were specifically asked to indicate whether they could recall having had any lessons on 5 particular environmental issues, namely air pollution, the greenhouse effect, soil pollution, ozone depletion and Australian agriculture. Students who could recall these lessons had stronger opinions about environmental issues. The finding also revealed that adolescents with strong environmental views tended to consume less meat. To conclude, interest in environmental issue ranged from concern, through optimism to pessimism. Interest in environmental issues varied across schools, gender and socio-economic status categories.

Hart (1978) examined the ecology comprehension, environmental information level and environmental attitude between BSCS biology and non-biology students. The study introduced an additional dimension to the hypothesized

relationship between environmental information and environmental attitude with the assumption that by understanding the fundamental ecology concepts, it may provide a more meaningful perspective on various environmental issues and problems. For this purpose, 300 twelfth grade students comprising of 153 biology students and 147 non-biology students were sampled. They were randomly selected from 9 comprehensive high schools in Saskatchewan, Canada. The students responded to a test of ecology comprehension, environmental information level and environmental attitude. The test consisted of 92 questions with 57 multiple choice questions and 35 attitude statement responses on a five-point Likert scale.

Hart's study revealed that there were significant difference between BSCS biology and non-biology students' ecology comprehension and environmental attitude but no difference between the groups' environmental information levels. The test also showed that there was no significant difference between males or females, but there were common factors influencing students' ecology comprehension, knowledge and attitude such as BSCS achievement, 12th grade average and students' IQ level. These findings showed that although students' exposure to BSCS biology may have not directly affected the respondents' attitude, it may have done so indirectly by exposing students to relevant ecological information.

Roth and Perez (1989) assessed the environmental knowledge and attitudes of the twelfth grade students in the Dominican Republic who received no exposure on environmental education. The purpose of the study was to collect

information that could be used as baseline data on environmental knowledge and attitudes. It also aimed to analyze the relationships between various variables such as students' perception of local and national environmental problems, gender of respondents, type of school curriculum and sources of environmental information. For this purpose, 690 students were sampled. It involved 30 students each from a randomly selected stratified sample of 23 secondary schools. A 60-item test was given to each of the students. The test was organized into 2 main sections: the knowledge section, which contained factual and conceptual items, and the attitudinal section.

Students' knowledge and attitudes toward environmental issues were low, with the total score averages between 51% - 55%, respectively. Of the 37 test items in the knowledge section, only 21 were correctly answered by more than half of the students. The total correct response rate in this section was about 51%. Students generally were more successful in answering the conceptual items than they were in answering the factual items. Out of the 20 conceptual items in this section, more than half of the students answered 17 conceptual items correctly compared to only half of the students answering 4 of the 17 factual items correctly. In the attitudinal section, approximately 55% of the students displayed positive attitude. Poverty and deforestation were most quoted as the most critical local environmental concerns while air and water contamination were perceived as the most important national environmental problems. Students' responses on the knowledge and attitudinal sections were found to be significantly related to students' gender, with males outscoring the females. It was also found that

students identified as independent reader scored significantly higher in the knowledge section. Roth and Perez (1989) found that there was no significant difference between the source of environmental information and students' attitudes. However, there was a substantial correlation between students' environmental issue knowledge and attitude toward the environment.

Gambro and Switzky (1996) assessed the environment knowledge among the tenth and twelfth grade American high school students in 1987 and 1989 when a sample of 2,900 tenth and twelfth grade students were taken respectively. Data was analyzed from the Longitudinal Study of American Youth (LSAY) which Miller, et al. (1991) carried out. It was a 4-year panel study of students, teachers and parents. The items analyzed include environmental issues such as acid rain, greenhouse effect and future sources of energy. The questions included general materials from life science, earth science and chemistry. The items measured how well students could recall specific facts and concepts as well as their application skill. Responses to the items were examined individually as well as collectively as a composite scale.

The results indicated that majority of the high school students have low level of environmental knowledge. A majority of 60% - 70% of the twelfth grade students were able to correctly answer the three basic environmental knowledge questions but only 41.6% - 45.6% were able to answer any four of the environmental knowledge application questions. Thus, most twelfth grade students were able to organize basic facts concerning environmental problems but they were unable to apply the knowledge possessed to determine the consequences

or solve those environmental issues. Students also demonstrated extremely little growth in environmental knowledge from tenth to twelfth grades. The study revealed that the proportion of students that were able to answer five or more items correctly, improved slightly from 28.5% (tenth grade) to 36.3% in their twelfth grade. Their level of environmental knowledge was insufficient for them to confront any environmental issues successfully or make any intelligent decisions concerning future environmental problems.

Brody (1990) assessed the understanding of pollution among the fourth, eighth and eleventh grade students. Students were interviewed on four important concepts to determine full understanding of the pollution problem, which included issues on solid and toxic waste as well as air, soil and water pollution. Representative samples of 105 students from 11 public schools in Maine were interviewed. Each interview began with a few broad questions to determine students' general understanding of pollution before probing in to more specific questions.

From the study, there seemed to be variation in the levels of understanding between students of different grades. The fourth graders' understanding on pollution was sensory in nature. It meant that they used their senses to understand the existence of pollution. The eighth graders however, had a more conceptual understanding of pollution and they did not depend on their senses. The eleventh graders reflected greater understanding of the concepts and the complex relationship between the environment. However, one or more grade levels noted several pollution misconceptions. Among the misconceptions

identified were 'anything natural is not pollution', 'the human race is an indestructible species' and 'biodegradable materials are not pollutants'. Misconceptions may reflect partial understanding due to lack of knowledge and they may not necessarily due to incorrect information. The results of this study can guide teaching strategies concerning current environmental problems and help learners gain an appreciation for the complex and multidisciplinary nature of science, technology and society and how they affect the environment.

In 1989, Brody and Koch studied the Fourth, Eighth and Eleventh grade students' knowledge on marine sciences and natural resource issues. The research addressed basic science and environmental education issues concerning the Gulf of Maine. One hundred and eighty-seven students from twelve schools in Maine were interviewed which consisted of 64 fourth graders, 60 eighth graders and 63 eleventh graders. Although schools were primarily selected based on its proximity and the interviewers' convenience, both rural and urban schools were well represented. The interviews were guided by general lead-in focus questions followed by more specific probing questions to determine the presence or absence of concepts and misconceptions and students' overall understanding of major principles.

From the study, the mean interview score for each content principle was relatively low at all grade levels. The highest mean score on any single principle was obtained by the eleventh graders on marine renewable and harvesting techniques but even this score reflect partial understanding of the principle. Older students showed greater comprehension of the natural resources and related

decision making concepts and processes. On the average, the grand means indicated that students at each of the grade level understood only a few marine science and natural resource concepts. Little gains were observed between the fourth and eleventh grade students. The interviews also revealed several misconceptions among the students.

Several general conclusions concerning students' knowledge of marine ecosystems, in particular with reference to the Gulf of Maine were made. Students learned only few basic marine science and resource concepts in the elementary grades. The overall understanding level of basic concepts and principles related to marine ecosystem dynamics, resource utilization, management and decision making processes were low. As students progressed through the grades, there were little assimilation of new concepts or differentiation of existing concepts. Many Maine students may not understand or appreciate the significant role of the marine environment in their state's socio-economic sector because of inadequate meaningful marine related curricular in school and or inadequate dissemination of existing curricula to teachers. Brody and Koch believed that the results from this study would be significant for the design and development of future marine science curricular.

Boyes, et. al. (1993) explored students' understanding of the greenhouse effect which looked into three aspects; the causes, consequences and possible cures of global warming. A closed questionnaire containing 36 questions was formulated. Questions were divided into three sections with each section bearing 12 questions. The first section contained questions on the possible effect if

greenhouse gases were to increase while the second formulated questions were on factors, which might exacerbate it. The final section covered on the actions that could be taken to reduce the greenhouse effect. A total of 702 students from grades 5-10 were sampled from 5 schools.

Students' perception about the greenhouse effect appeared to fall into a number of categories, according to their prevalence. Generally, more than 80% of the students from all grades understood that greenhouse effect causes warming of the earth. More than half of the students (64%) understood the basic mechanism of global warming and the increased entrapment of reradiate energy by pollutants in the earth's atmosphere. The proportion of students with this understanding remained approximately constant over the age group studied. However, a similar proportion of students (67%) also gave positive responses to the statement that increased penetration of solar radiation due to atmospheric pollutants such as methane, carbon dioxide, oxides of nitrogen and ozone caused global warming. This idea however did not prevail much in the older students. Studies of the contributing factor suggested that students basically understood the actions that may ameliorate the greenhouse effect. Majority (87%) of the students believed that tree planting might reduce greenhouse effect. Other actions included paper recycling and energy generation from renewable resources and nuclear power.

In contrast, the questionnaire also revealed several misconceptions. Among the popular misconceptions revealed were that students (84%) believed that hole in the ozone layer increased greenhouse effect. A rise in global warming would produce an increase in skin cancer, which in reality is a consequence of

ozone-layer depletion. Other misconceptions included were when few students understood that ground-level ozone is a greenhouse gas and some students believed that improved protection of rare species would reduce global warming. Most of these misconceptions seemed to persist in similar proportion even at higher levels and many of these misconceptions were similar in different age groups. However, more than 84% of the students believed that using lead free gasoline would reduce global warming. This idea is not only persisting but the percentage of students holding to this idea increased with grade levels.

A general conclusion drawn from the results was that some students seemed to be confused with different major environmental problems - global warming and ozone layer depletion in particular, but also radioactive contamination, acid precipitation and even global biodiversity reduction. One of the important tasks of educators is to disentangle these confusions.

2.3. Studies Pertaining to Environmental Knowledge, Awareness and Attitude in Malaysia

The development of environmental education in Malaysia is still crawling to achieve its goal. Since 1980's, two extensive surveys on public environmental awareness were conducted. Department of Environment (1986) conducted the first survey in Selangor. A total of 1002 respondents between the ages of 15 and 16 were interviewed. The main aim was to assess the understanding, awareness and attitude of respondents on various environment and pollution issues, their commitment level and knowledge on the role of the Department of Environment.

The study indicated that only a handful of the respondents understood the meaning of 'environment' but indicated high level of awareness in environmental pollution issues. Environmental issues were not a priority as it was ranked second last compared to social and economic issues. The general public was also reluctant towards any measures taken, such as environmental tax to improve environmental pollution problems. This might be due to the low level of environmental knowledge and awareness and also the economic recession faced by Malaysians during this period.

The Economic Planning Unit followed-up with another survey study in 1996. The objective of the study was to obtain information on environmental awareness among Malaysians and to identify the factors influencing the level of environmental awareness. The ultimate aim of the survey was to prepare and implement a programme, which was suitable and successful in raising environmental awareness level among Malaysians. A total of 3,564 adults and students were sampled. Sample distributions were according to stratum (urban or rural), zone (north, south, central and east of Peninsular Malaysia, Sabah and Sarawak), race and gender. Several issues covered in the survey include air pollution, ozone depletion, haze, water pollution, open burning and recycling.

The results from the study presented a brighter note to the development of Malaysian's environmental awareness level. The survey results showed that 37% of Malaysians were able to give a definition of the 'environment' while 34% were able to attempt some vague description. On the other hand, 87% of Malaysians have heard of environmental pollution. This is further strengthened by the fact that

nine out of ten Malaysians were aware of environmental pollution and felt that the problem has increased during the last decade.

When respondents were asked to rank ten issues which needed the authorities attention, environmental issues was listed in the fifth position, which sees an improvement from the 1986 survey. However, the result shows very low participation rate (22%) among Malaysians. Survey showed that the Malays or Bumiputera displayed higher involvement (28%) compared to 8% among the Chinese and 25% among other races. About 40% of the non-participating respondents stated the reason of not having an opportunity to get involved or were unaware of such programmes and activities. Age displayed as an important factor in determining the level of environmental awareness and participation. The younger age group, particularly the youth group (15-39 years), displayed greater awareness and involvement in environmental issues. The bulk of environmental information obtained by Malaysians was from the television or radio (70%). The study showed a positive indicator with 71% of the respondents agreed that the public plays a greater responsibility than the government (66%) in controlling environmental pollution.

Finally, 95% of Malaysians agreed that environmental education stands as a firm fundamental for environmental awareness and behavior and that environmental education should be introduced in schools.

Chiang (1981) studied the effects of field study experience on environmental knowledge and attitude among the third year science students in University of Malaya. The study aimed to ascertain whether groups of students in

the two programmes, sex and ability levels influenced the effects of field study experience on environmental knowledge and environmental attitude, and the relation between environmental knowledge and environmental attitudes. Students' attitude towards the activities during the field study course was also obtained. Six hypotheses were set for this purpose. Three questionnaires, namely, the Test on Environmental Knowledge and Understanding, The Environmental Attitude Questionnaire and the Attitude towards the Field Study Course Questionnaire were administered in a pre-test and post-test design to 94 third year students enrolled in the Bachelor of Science and Bachelor of Science Education programmes.

Generally, the findings indicated that the environmental knowledge and understanding gained from field study experience showed no significant influence on students' environmental attitudes. A significant positive relationship was observed between students' ability level and environmental knowledge. However, a non-significant relationship exists between students' ability levels and environmental attitudes. Environmental knowledge was positively correlated with environmental attitude for the total sample student. When students' attitude and reaction towards field study course was surveyed, more than 90% of the students agreed that the field study experience was beneficial, rewarding, meaningful, important, valuable and enjoyable. It was recognized that for field studies to be effective in schools, a well planned pre-services and in-service teacher preparation program are essential. Teacher training programme should incorporate sufficient period of field study and provide effective, relevant experiences for teacher

trainees towards developing in their students an appreciation of the outdoors, relevant environmental knowledge, desired environmental attitudes and appropriate teaching skills.

Teoh (1996) examined the status of environmental knowledge among teacher trainees on selected environmental problems and issues. The influence of independent variables such as gender, subject specialization, academic qualification (SPM and STPM holders) and background of academic streaming (Science and Commerce) on environmental knowledge were examined. The sample consisted of 231 teacher trainees from a teacher training college in Kuantan, Pahang. Data was collected using a test instrument containing 4 parts namely 'Development and Environmental Quality' (EQUL), 'Ecological Balance' (ECBL), 'Natural Resource Management' (NREM) and 'Control and Protection of the Environment' (COPR).

Generally, teacher trainees scored an average of 15.83 (52.77%) for the total test comprising of 30 items. The study showed that gender and academic qualification did not have significant influence on teacher trainers' environmental knowledge. They seemed to perform better in environmental issues relating to natural resource management and conservation. However, they were least knowledgeable in the development and environmental quality issues with reference to ozone layer and environmental health and safety.

Cheong (1980) conducted an environmental awareness survey on a sample of form 4 Science students in Malaysia. The study aimed to examine the level of students' environmental knowledge, perception and attitudes. However, the study

revealed that students' factual knowledge especially on pollution, radiation, energy and population growth was low.

Ponniah (1981) examined the level of environmental knowledge, understanding and attitudes of secondary students in Malaysia. A total of 332 form 2 and 3 students from an urban and rural co-educational schools in Selangor were sampled. A test on students' knowledge, understanding and attitude were surveyed which included variables such as gender, grade level, ability level and location of school.

The study revealed that students had considerable knowledge about the causes, sources, effect, examples and mitigation aspects of the problem. However, their knowledge and understanding on pollution concepts such as environmental pollution and pollutants, and knowledge on organizations and agencies involved in pollution control were very poor. Generally, secondary schools students' portrayed positive attitude towards environmental pollution issues and attempted to know more about it. This study also revealed that there was no significant difference on the attainment of knowledge on environmental pollution between boys and girls. Most of the respondents agreed that school and mass media, particularly, television, radio and newspaper played an important role in disseminating environmental pollution information. Students from good classes performed far better than the rest of the students.

Jayatilaka's (1982) study aimed to determine the influence of teaching ecology in schools to the level of environmental awareness among secondary school students in Malaysia. The sample consisted of 111 Form Four students

from both Science and Commerce streams in Klang. Students were exposed to ecology based on their respective syllabus by their teachers and they were divided into groups according to their capability level; high, moderate and low. Data obtained through an objective test based on the ecology content of the Modern Biology and General Science syllabus to examine students' understanding of ecological concepts. To determine students' level of environmental awareness, a Likert scale questionnaire on environmental issues was put forward.

The result of this study indicated that environmental awareness among students was low although they were exposed to ecology study. None of the 111 students in the sample were highly aware of the local environmental problems with only 40% were slightly aware, 5% of respondents had very high environmental awareness and another 5% were not aware at all. The results showed that ecology study influences students' academic achievement but academic ability and streaming do not have any relationship to students' knowledge and understanding of environmental issues.

Chuah (1989) studied the attitude of Standard Six students on 3 categories of environmental issues, which involves the physical, biological and human aspects of the environment. The study aimed to observe and determine students' moral capability and the relationship with action on the environment. It also compared the moral value, environmental knowledge and students' participation between genders and socio-economic status. A total of 347 students were sampled comprising of 178 boys and 169 girls from four schools in Penang Island. Data collection was carried out by means of five instruments, namely

- a) Pupils' Attitudes towards Environmental Issues Questionnaire (PAE)
- b) Pupils' Moral Reasoning Protocol (PMR)
- c) Pupils' Moral Commitment towards Resolving Environmental Issues Questionnaire (PCE)
- d) Pupils' Biodata Questionnaire (PBD)

The study revealed that 98.5% of the Standard 6 students displayed moderate to high level of overall environmental attitude towards environmental issues. Students portrayed more positive attitude towards the biological environmental issues such as pollution, health and safety and ecology relationship compared to issues on natural resources, landuse, cleanliness and energy. The study also revealed that there were no significant overall environmental attitude differences between boys and girls. But students from higher socio-economic status showed greater interest in environmental issues compared to those from lower socio-economic background. The study showed that student' environmental attitude had a positive correlation with environmental knowledge.

Fadzilah (1999) assessed the level of environmental awareness among primary and secondary school students in Malaysia. A case study was carried out to compare between both urban and rural schools. The group of students sampled in this study was those from 11-12 and 15-16 years old. A total of 963 students were sampled comprising of 486 primary students and 477 secondary students. The schools were selected from Kuala Lumpur, Termeloh town areas and the rural areas around Termeloh, Pahang. The variables involved in the study included environmental knowledge, level of awareness, attitudes, values and religious

knowledge pertaining to the environment as the dependant variable while gender, socio-economic status, academic achievement, number of children in the family and location of the school which function as independent variables. A Likert scale questionnaire was formulated to obtain data on this study.

The findings on the level of environmental awareness on the environment suggest positive results. Primary school students possess higher environmental awareness level compared to secondary school students. Primary and secondary school girls were found to possess higher level of environmental knowledge and awareness compared to boys. The findings also showed that these groups of students have positive attitudes and values towards the environment. They also have sufficient religious knowledge pertaining to environmental issues. It was found that the influencing factors towards environmental information, awareness, attitudes, values and religious knowledge were related to family's socio-economic status, knowledge and information obtained from both inside and outside of school. Generally, the study revealed that students from the city, who came from a higher socio-economic status and with higher academic level possessed higher levels of environmental knowledge and awareness.

Lim (1999) studied the Malaysian secondary school students' environmental attitude and knowledge. A total of 355 form 5 students were sampled. Questionnaires were used as an instrument for the study. The questionnaire was divided into three sections with section A as the attitude sub-scale, consisting of 36 items represented in a 5 point Likert-type response format. Section B contained the knowledge sub-scale, which comprises of 30 multiple

choice items and section C with the demographic details of the respondents. There were 6 groups variables analyzed in this study and they were verbal commitment, actual commitment, affect attitude, knowledge and total scores.

The study revealed that Malaysian students possessed good attitudes towards the environment. Although Malaysian students had strong feelings or emotions towards environmental issues, they were still reluctant to commit themselves in taking actions to improve the environment. Malaysian students generally possessed low levels of environmental knowledge in environmental issues especially among the arts stream students. In terms of gender, girls generally performed better than the boys in environmental issues but this did not generally mean they were more committed than the boys.

Among the major ethnic groups, the Bumiputera students displayed stronger emotions towards the environment but were least committed verbally to environmental issues. The Indian students might be verbally committed, but they were not adequately furnished with essential environmental knowledge that would enable them to deal favorably with environmental issues. Chinese students had the most knowledge but they were average in terms of environmental attitude. Nevertheless, the other two ethnic groups took more active interest in pro-environmental activities than the Chinese.

The study also revealed that students' involvement in environmental activities such as nature club and nature camps did not bring fruitful results. It did not promote good environmental attitudes effectively although it improved knowledge level marginally. Students' whose parents were educators scored

highest in these two sub-scales. However, students whose parents were from both the administrative and supervisory area scored the lowest in actual commitment component although they might have comparatively high knowledge scores. Students, whose parents were nurses, police, labourer retirees and salesmen scored lowest in knowledge sub-scale. The study revealed that the main source of information on environmental issues was the mass media, specifically the television and radio (mean 4.34) and the press (mean 4.26). Students relied on the mass media and schools and to a certain degree nature clubs for information on environmental issues while influence from family members and friends was ranked among the lowest.

In 1999, Sundram assessed the awareness and attitudes of the Klang Valley residents towards sustainable solid waste management. The study aimed to gain residents' level of knowledge and awareness on solid waste issues and to determine the variables that might influence the relationship between a resident level of awareness, willingness to participate or co-operate, sex, race, age and academic qualifications. 170 residents from various locations within the Klang Valley such as Kuala Lumpur, Petaling Jaya, Shah Alam, Klang, Rawang and Kajang were interviewed. Respondents were interviewed based on four items: General Information, Municipal Solid Waste Storage and Disposal, Solid Waste Management and Cleaner Technologies and Sustainable Waste Management.

The results showed that a majority of the respondents (59.4%) were moderately aware about solid waste management issues whilst 33.9% of the respondents were moderately aware of cleaner technology programme. In contrast

to the awareness level, about 42% of the respondents were unwilling to participate or co-operate in cleaner technology program. The results also indicated that in all the three categories of solid waste management awareness, cleaner technologies awareness and willingness to co-operate or participate in cleaner technology programme, the variable sex and race of the respondents were not significant influencing factors. Similarly, resident's age was also not important in determining solid waste management awareness or cleaner technology awareness. However, a resident's age seemed to be significant in terms of his or her willingness to participate or co-operate in cleaner technology programme. In all the three areas, a resident's academic qualification was identified as an influencing factor.

The resident's awareness on solid waste management issue and cleaner technology were also significantly and positively correlated at 54.9%. Variations in respondents' solid waste awareness were also found to be correlated with their willingness to participate or co-operate in cleaner technology programme (33.2%). There were also a 59.7% correlation between a respondent's willingness to co-operate and their cleaner technology awareness levels. The findings from this study implied that there was a need for greater emphasis on increasing the public's awareness and knowledge in the area of sustainable solid waste management.

Vasudevan (1999) conducted a study on the knowledge of greenhouse effect (GHE) among form 4 students in Malaysia. It aimed to study the level of students' knowledge and the influence of variables such as knowledge on current environmental issues, subject specialization (Biology or non-biology), gender and

sources of information on the attainment of their GHE knowledge. A total of 205 form 4 students were sampled in Sandakan and data were obtained using a 36-item questionnaire. The analysis of the data involved both descriptive and inferential statistics.

The results showed that there exists a high level of GHE knowledge among the respondents. However, several misconceptions were also discovered, especially the confusion between the ozone layer depletion and the GHE. Both the variables of subject specialization did not seem to influence respondents' ability to comprehend the causes, consequences and cures of the GHE. Television and newspaper were found to be the most popular sources of GHE information. The results of the study have implications for teaching about GHE and the design of environmental education curriculum materials based upon students' knowledge.

Based on the discussions, studies conducted in other countries covered a wider range of specific environmental issues such as Brody and Koch's (1989) study on fourth, eighth and eleventh grade students' knowledge on marine science and natural resource issues, Brody's (1990) study on the understanding of pollution among the fourth, eighth and eleventh grade students and Boyes et al (1993) study on students' understanding of the greenhouse effect. Studies in other countries also covered a wider range of variable such as political influence (Thompson & Gasteiger, 1985; Hsu & Roth, 1996) in addition to the socio-economic variables such as age, level of education, income, culture and religion. Hence, a general conclusion on the level of awareness, knowledge and attitude

cannot be determined as it varies according to the specific environmental issues tested and country.

However, studies conducted in Malaysia were rather homogenous in terms of the variables tested. Studies in Malaysia focused on a wide range of general environmental issues such as pollution, natural resources and ecological relationship with limited studies focusing on a specific environmental issues such as Vasudevan's (1999) study which assessed students' environmental knowledge on greenhouse effect and Sundram's (1999) study on the awareness and attitudes of the Klang Valley residents towards sustainable solid waste management. Thus, the studies generally showed that Malaysians have low to moderate level of awareness and environmental knowledge (Cheong, 1980; Jayatilaka, 1982; Department of Environment, 1986; Lim, 1999) but positive attitude (Ponniah, 1981; Chuah, 1989; Fadzillah, 1999 and Lim, 1999).

Thus, this study attempts to assess the level of environmental knowledge, awareness and attitude of secondary school students in Melaka towards tropical rainforest issues and its associated issues.