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A STUDY OF STUDENT ENVIRONMENTAL KNOWLEDGE AND ATTITUDES IN SELECTED HIGH SCHOOLS IN THE PERMIAN BASIN REGION OF TEXAS

DISSERTATION

Presented to the Graduate Council of the
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By

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This study is a partial replication of research conducted by Perkes (1973). The problem in this study is to assess the magnitude of the relationship between student knowledge of the environment, student gender, grade level, and size of school attended; and the level of attitudinal differences between students based upon student gender, grade level, and the size of school that students attend.

Methods of data collection include the use of an environmental knowledge and attitude inventory used by Perkes (1973) and modified by Hardy and Fox (1976). This thesis includes an added dimension, a survey of environmental education curricula in the Permian Basin Region of Texas.

Correlational findings measure levels of significant relationships between student knowledge, gender, grade level, and size of school; and Analysis of Variance measures of significant differences in student attitudes based upon gender, grade level, and size of school. Prior to discussing levels of significance, descriptive statistics enrich the total research effort.

The five major variables: environmental knowledge, environmental attitudes, gender, grade level, and size of high school that students attend used in this study, are generally representative of variables used by Perkes (1973). Findings in this study may reflect or differ from Perkes' findings. Major modifications in this study include a regional versus a multistate approach, the use of school size as a variable versus state of residence or size of community in which students reside and the use of a curriculum survey.

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CHAPTER I

INTRODUCTION

Two decades ago, the initial Earth Day brought environmental issues to public attention. Before the 1970's ended, the EPA was formed, the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act were passed to protect the environment (Reilly, 1990). Writing after the first Earth Day in April of 1970, Pettus (1976) believes the aim of Environmental Education is to inform students and to create sound environmental policies on our planet. According to Pettus, we must shape attitudes to invoke environmentally sound responses in the cognitive, affective, and behavioral areas. Pettus feels that research shows that more knowledge will produce better behaviors. At present, Reilly believes, the remedies of past decades cannot solve the environmental problems of the 1990's (Reilly, 1990). Still, today's educators may not know enough about attitudes to change or alter them in a manner that will enhance positive environmental problem-solving strategies.

Both Pettus (1976) and Reilly (1990) voice the same concerns about making prudent environmental decisions. Both are, in essence, alluding either directly or

indirectly to issues of knowing about the environment and developing befitting attitudes towards the environment.

Environmentalists today feel that humans, unlike other species, have the ability to think, feel, and act. The earth is our collective concern. Environmental decisions are philosophically grounded decisions and affect all life. Better environmental decisions ought to be made correctly when students receive proper training, when students care about man and nature, and when universal consequences are matters of consideration (Petulla, 1989; De Groot, 1989; Shearman, 1990; Van Riet & Cooks, 1990; Reilly, 1990; Busch, 1990; Hunsaker, et al, 1990; La Point, et al, 1989; Teeter, 1989; & Webber, et al, 1988).

An education theorist, Lee F. Anderson (1991), justifies the need for environmental research with an environmental and/or curricular emphasis. Anderson calls for global education stating,

> The Earth of the 20th century is a much more integrated planet than it was in 1400. The massive two-way exchanges of plants, animals, and microorganisms between the 'Old' and 'New' Worlds that followed European and African intrusion into the Americas, and European entry into Australia, New Zealand, and other Pacific islands, have substantially homogenized the plants and animals we eat as food. Viruses originating in the Eastern Hemisphere make us

> ill almost as frequently as the Western Hemisphere's home-grown varieties. Concerns over the depletion of the ozone layer, global warming, ocean pollution, acid rain, deforestation and desertification, toxic and nuclear waste disposal, and the extinction of animal and plant species are resulting in international cooperation (1990, p. 16).

Anderson (1991) concludes that young Americans must understand global interdependence if we are to move into the next century and survive. He says, "To do otherwise would be intellectually stupid and socially irresponsible because we would be putting at risk the children we love, the students we teach, and the nation we cherish" (p.33).

One broad justification for this study is that any evidence supporting curriculum and the relatedness of environmental knowledge and attitudes is beneficial in the minds and hearts of those who seek to preserve and protect the Earth and its largess (Petulla, 1989; Weiner, 1990; Piasecki & Asmus, 1990; & Pope, 1991).

From a research perspective, the need to understand student environmental attitudes and levels of student environmental knowledge is supported in research conducted by Perkes (1973). In a comprehensive study of student environmental attitudes and student environmental knowledge, Perkes asks, "How do results from the Great Lakes states and Far West states compare with those of

other regions of the United States? ....Comparisons need to be made when research on other regions is complete" (p. 141). Perkes' question provided the initial impetus for this study.

Consequently, this study is a partial response to Perkes' (1973) call for comparative research from other regions of the United States by studying a sample of similar subjects in the Permian Basin Region of Texas. Additionally, this study is based on Hardy and Fox's (1976) study of student environmental attitudes and knowledge. Results of this study may support or refute 1970's research: specifically, research of Perkes (1973) and Hardy and Fox (1976). Hopefully, this study, however limited in scope, will benefit not only the researcher but also will be of use and promote a better understanding of student environmental knowledge levels, attitude levels, and environmental curricula in the Permian Basin Region of Texas.

Statement of the Problem

The primary problem in this study will be to determine and compare the levels of environmental knowledge and attitudes of 10th and 12th grade students attending selected high schools in the Permian Basin Region of Texas. A second focus is to assess the state of environmental education in the Permian Basin Area.

Hypotheses

1. There is no significant difference between environmental knowledge level based upon student gender.

2. There is no significant difference between environmental knowledge level based upon student grade level.

3. There is no significant difference between environmental knowledge level based upon the size of the school a student attends.

4. There is no significant difference in environmental attitude based upon student gender.

5. There is no significant difference in environmental attitude based upon student grade level.

6. There is no significant difference in environmental attitude based upon the size of the school a student attends.

7. There is no significant relationship between student level of environmental knowledge and student environmental attitude for the total sample or within subgroups in this study.

Besides the above research hypotheses, a supplemental question on how and to what extent selected school districts in the Permian Basin Region have integrated environmental education into their high school curricula was addressed. A curriculum survey was used to gather curricular information (See Appendix B).

After analysis of the above hypotheses and question, findings of this study were compared to those of Perkes (1973) and Hardy and Fox (1976) if such comparisons are appropriate. Following the discussion of stated Research Hypotheses, results of the curriculum survey will be evaluated.

Statistics used to analyze hypotheses and questions in this study included descriptive statistics, the use of Analysis of Variance measures and the Pearson Product Moment Correlation. Tables in Chapter IV show all statistics.

Limitations

1. Caution must be exercised in generalizing the results of this study to a larger population.

2. This study focuses on students who attend selected high schools in the Permian Basin Region of Texas.

3. This study focuses on 10th and 12th grade level students.

Definition of Terms

The following terms will be used in the body of this study:

1. Environmental attitude--an inferred trait within an individual involving a tendency to perceive and react in a specific manner toward some facet of the environment, e.g., environmental concern (Perkes, 1973).

2. Environmental education (EE)--any program of education related to outdoor education: man's relationship to his cultural, natural, and physical environment; the development of environmental knowledge, awareness, and ethics; and rational and logical use of the environment (Perkes, 1973).

3. Environmental knowledge--facts, ideas, and principles needed to explain, understand, and predict environmental phenomena (Perkes, 1973).

CHAPTER II

REVIEW OF THE LITERATURE

Environmental Education research regarding student attitudes, opinions, beliefs, and levels of knowledge appeared to be less than consistent as the following articles revealed. Additionally, literature reviewed indicated that the area of environmental studies is an expanding field including educators, scientists, and activists. This review consisted of an overview of articles written by environmentally concerned educators and researchers during the 1970's, 1980's and 1990's. The review was divided into five sections: (1) A philosophical basis for the study, (2) the 1970's, (3) the 1980's and 1990's, (4) trends and contemporary issues and (5) implications.

Philosophical Basis for the Study

The philosophical antecedents for this study can be found in a dispute between Plato and Aristotle over the nature of moral virtue and its relationship to moral action. Plato took an episternological approach, arguing that right action depends on knowledge. In Plato's dialogue, the Meno, Socrates rejects the ideas that virtue is innate or that it is developed by practice, and argues

that immoral behavior results from confusion about virtue and the good. People perform bad acts believing that they are good (77B-78B). Much of the dialogue is devoted to an examination of knowledge and true opinion. Plato maintains that opinion guides moral action as well as knowledge, if the opinion is true. However, because the truth of opinion is not known in advance, knowledge is to be preferred over opinion whenever knowledge is available (97B-98D). Although Plato suggests in the Meno that knowledge of virtue may not be possible, on the grounds that there is no evidence that it has ever been taught by anyone of high moral standings in Athens, in the Republic (508E-511E), where his theory is most fully developed, he presents the concept of the Good as the central element in his entire philosophy. The Good is not only the foundation of ethics, but also of metaphysics and episternology.

Aristotle explicitly rejects Plato's view in the Nicomachean Ethics: "We are inquiring not merely to know what virtue is, but in order to become good, for otherwise the knowledge would avail us nothing. . ." (bk. 2, sec. 1). According to Aristotle, virtues, the moral characteristics which collectively make up moral character, are acquired through practice-the performance of moral actions-and usually require positive and negative reinforcement. Aristotle argues that virtues are habits which dispose us to act in specific ways. These habits or dispositions are

means between two extremes, one of excess and one of deficiency, and are culturally relative-that is, dependent on specific cultural values and ideals. According to Aristotle, proper grasp of particular ideals involves perception, not knowledge (bk. 2, sec. 0). It is not simply a matter of coming to know the concept of courage, as Plato claimed, but of perceiving it as it exists as a social ideal in a particular society. A person who has developed improper moral habits will see the mean as an extreme. For example, a properly courageous person will appear to be a coward to a foolhardy person and a foolhardy person to a coward. To the degree that knowledge is involved, it is not moral knowledge, but knowledge of particular circumstances-for example, who is acting, what is being done, who or what is affected.

The definition of an environmental attitude as developed by Perkes is closely related to Aristotle's position. According to Perkes, attitudes are inferred traits within an individual involving a tendency to perceive and react in a specific manner toward some fact of the environment. Such a definition is akin to Aristotle's notion of virtue as a habitual disposition and provides a link between Aristotle and the present study. Additionally, the philosophical basis of this study of student environmental attitudes is implicitly grounded in

axiological issues concerning right action derived from both Plato and Aristotle.

The 1970's

Cohen (1973) said there was a wide range of views regarding the importance of knowledge and attitudes in the development and appraisal of environmental education programs. Cohen compared the environmental attitudes of two groups of high school students who had different levels of environmental knowledge. Cohen's survey of students showed a relationship between environmental attitudes and knowledge. He found that groups with more knowledge had different attitudes and were more willing to express environmental attitudes than less knowledgeable counterparts. Cohen ended by asking, "Why do such relationships occur?"

A comprehensive dissertation by Perkes (1973) on the relationship between knowledge and attitudes of 10th and 12th grade students suggested that most schools realize the importance and the need to integrate environmental programs into their respective curricula. Perkes believed many curricular decisions happen with insufficient expertise and information. To help correct deficiencies, Perkes wanted to collect data to be used in making curricular decisions.

To gather data, Perkes used an inventory allowing student respondents to reveal their levels of environmental knowledge and their levels of environmental attitudes.

Perkes administered inventories to sixty 10th and 12th grade students in 199 schools located in states in the Great Lakes area and in the Far West. Perkes' findings showed that males did significantly better than females on environmental knowledge inventory items. Twelfth graders scored significantly higher than tenth graders on knowledge items. The size of the community in which students reside was not significantly related to student environmental knowledge. Regarding environmental attitudes, Perkes findings indicated that attitudes were significantly different based upon both students' states of residence and the size of community in which a student lived. No statistically significant differences based upon gender or grade level of students were found.

In analyzing attitudinal data, Perkes concluded, environmental attitudes that are broad in nature and demand no active commitment or action by students were the most common attitudes. When attitudes called for proactive demonstrations of personal commitment through personal action students viewed such attitudes less favorably. This factor induced Perkes to state, "A further investigation comparing both males and females in both the 10th and 12th grades would add substantially to an explanation of results in this study." (p. 14)

Carol Gilligan's (1982 & 1988, Ed.) research on moral differences between males and females may partially explain

the gender differences in Perkes' (1973) research and related studies. In Gilligan's research, males tended to operate using a 'justice' perspective and functioned on the basis of what is right, fair, and contractually just. Females made decisions to maintain relationships using the 'care' perspective and a consensual approach regardless of the rules. Thus, although not directly related to all cited attitudinal educational research, a knowledge of Gilligan's moral model may allow interpretation of such attitudinal research with greater facility and insight.

In a partial replication of Perkes (1973) research by Hardy and Fox (1976) entitled, "Environmental Awareness in Rural, Suburban, and Urban Settings," the researchers found attitudinal differences between subgroups tested were significantly different. Secondly, Hardy and Fox found there was a significant relationship between environmental knowledge and environmental attitudes for suburban and inner city kids, but not for rural students. Hardy and Fox concluded,

> Hopefully, a careful consideration of student characteristics will lead to the future preparation of environmental education materials that will yield increasingly positive attitude values among all segments of the school population (p. 223).

An attitudinal study by Steiner (1973), indicated there were significant attitudinal differences between

females and males. He asserted responses for urban seniors differed significantly from responses of suburbanites and rural seniors, and that attitudes for seniors who took more science courses were more positive than for seniors who took fewer science courses. Non-science students showed less conviction of attitude than science students. The latter showed greater positive and negative variability on issues. Attitudes toward the relationship of science and technology were not significantly different and may have related to variables outside of the school and variables found in the typical science studies. Steiner ended by asking, "How well do we teach our pupils in science courses to deal with societal issues?" and "Do our students have the knowledge and attitudes required to resolve environmentally based problems?"

Ditton and Johnson (1974) contended that students show concern for environmental decay and degradation. Yet, students did not display a high level of environmental knowledge. In fact, students had no more knowledge than the general population. Even if schools were to institute special environmental education curricula, attitudes, a priori, may be the key to effectively using knowledge.

In Doran, Guerin and Sarnowski's (1974) study of junior high students' awareness of environmental problems, the authors said that students in grades seven to nine did not see the environmental significance of the lawn mower,

the jack hammer, chain saw, buses and other mechanical devices, appliances or technologies. These students believed they were "too young" to do much about environmental problems. Doran, et al, felt that their attitudinal inventory, when used successfully with instruction in an ecology unit or with student projects, could be the key to creating student commitment to changing the environment in their communities.

Past research evidence has been contradictory, Pettus (1976) said, particularly regarding levels of information and levels of environmental concern. Still, research, even though fragmentary, suggested there was a relationship between one's level of education, one's level of knowledge and one's level of environmental concern. Research suggested there were significant relationships between working, living conditions and environmental activities. Cultural and subcultural beliefs related to environmental attitudes and some attitudes conflicted with other attitudes, e.g., privately held attitudes may be antithetical to publicly held ones, and creating environmentally sensitive attitudes may take years.

In a review of science education influences, Peterson and Carlson (1979) stated research showed that science teachers spark antienvironmentalism in students. Science teachers believe that science is harder than other subjects and grade accordingly. Students were the beneficiaries of

teacher paradigms and quickly formulated negative attitudes in science classes while continually making poor grades. The authors called for experimental research to determine whether teacher attitudes, methods and expectations impacted student attitudes. If research does show a teacher-generated effect, then the authors called for a science education reform in order to create positive environmental attitudes in science students.

An attitudinal study by Kuhn (1979) focusing on energy, showed that males and females had significantly different attitudes regarding energy use. To illustrate, Kuhn said males tend to believe in technological solutions and tax incentives, while females tended to support greater governmental intervention and regulation. Kuhn believed that attitudes of both males and females related to the amount of information that they had concerning energy. Kuhn suggested science classes are sexist, and that as a consequence, males acquire more information than females because of the bias of science teachers. Kuhn's insights may relate to Gilligan's research (1982) and, if related, Kuhn's discussion of attitudinal differences may have current implications for curricular specialist beyond the obvious. Additionally, Kuhn's attitudinal findings are consistent with research evidence found in Perkes' (1973) study and Steiner's (1973) findings on science education. Echoing both Steiner (1973) and Peterson, et al, (1979)

Kuhn reiterated that science education and science teachers may have important influences on males and females attitudinally and cognitively.

Direct experience was the focus of a study by Collins, et al, (1979) designed to forge positive environmental attitudes by encouraging students to participate in an educative environmental field trip experience. They asserted environmental attitudes improved when students personally participated in a positive field trip experience. The researchers believed that attitudes can be changed on a short-term basis by using field trips and asserted that there was some basis for expecting some short-term effects to last. One relatively long-term effect of such experience is maintenance of positive attitudes towards the environment for and beyond one year among 4th grade students.

Cumulatively, articles from the 70's were quite divergent. Several articles did suggest that gender, grade level, and/or location did impact environmental knowledge and/or attitudes (Steiner, 1973; Perkes, 1973; Hardy, et al, 1976, Peterson, et al, 1979; & Collins, et al, 1979).

The 1980's & 1990's

According to Bedwell (1984), current environmental education programs of that day were geared toward the integration of social and environmental themes into biology instruction. Bedwell replicated previous research in

social studies education and found that secondary teachers in the area of biology education were similar to social studies teachers. In both studies, teachers showed less environmental concern than students and parents, except in cases where students were not college or university preparatory students. Teacher effects discussed by Bedwell reflected previously mentioned influences by Peterson, et al (1979). Secondly, Bedwell's research can readily be assessed in context of research on teaching (Shulman, 1986; Good, 1986; Brophy, 1986; Brophy and Good, 1986).

In discussing values education, Horsley (1984) stated that American students had more positive attitudes toward the environment than foreign students. Horsley speculated American students exhibited such attitudes because values education is an integral part of the curricula in our public schools. Borden (1984/85) said educators are aware that behaviors are linked to sociological factors of educational level, socioeconomic and political orientations of people. He reported research demonstrates that one's attitude toward pollution was a strong predictor of anti-pollution activities. Borden found that 87% of the subjects felt that technology would provide the tools to solve environmental problems and implored educators to impart more than facts--to include strategies for solving environmental problems. Borden argued we must de-mythologize the cherished belief in the "technological fix"

and that advocates of such solutions exhibit low levels of environmental concern when compared to persons who do not believe that technology alone will remedy our problems.

Karst (1985) found that opinions of students were significantly different based upon sex, region of the country and, to some extent, academic preparation. Karst's analysis revealed no significant differences in opinion based upon grade level or conservation attitudes. Karst's findings were consistent with those of Steiner (1973) regarding gender, consistent with Perkes, and Hardy and Fox (1976) regarding location, but were not consistent with Perkes' findings regarding grade level influences on attitudes. Additionally, Karst asserted, females had more positive attitudes towards resource conservation and were more willing to make sacrifices to conserve resources than male counterparts, a finding that was consistent with Gilligan (1982). Additionally, Northern students were more aware of environmental issues and are more energy conscious than their Southern counterparts.

Northern students were more willing to support stricter governmental guidelines and regulations on the design of automobiles. Interestingly, Karst's findings conflicted with a Gallup Poll which strongly implied that Southern students were more environmentally aware than Northern counterparts. Karst wondered whether our current curricula in both the North and South was environmentally

sound, and suggested future researchers design studies to discover why females exhibited more positive attitudes than males at the secondary school level. A grade level study by Brody, et al (1987/88) revealed that knowledge varies greatly from the 4th to the 11th grade. The authors noted that environmental education was a multidisciplinary affair and were supported by Anderson (1991), Tye (1991), Lamy (1991) and Kirkwood (1991).

An attitudinal study by Kellert (1985) indicated that younger children perceived animals differently than older children. From ages six to nine children were more emotional; from ages ten to 13 they used data; and older children, ages 14 and up, matured and showed greater ethical and ecological concern. Kellert stated younger children best responded to emotional input, children during middle childhood responded better to factual information, and the teenage years were the optimum years to provide ethical and ecological training. Kellert declared educators must attend to attitudinal differences at age/grade levels, noting racial and demographic variables may also influence attitudes. Kellert's research is partially supported by Brody, et al (1987/88) regarding the influences of grade level and gender on environmental attitudes.

Lawrenz and Dantchik (1985) state that earlier research supported their findings showing a relationship

between grade level and attitude. They said gender-based attitudinal differences were more pronounced in high school. Lawrenz and Dantchik's study focused on 4th grade, 7th grade, and high school students. Their study partially reaffirmed Kellert's (1985) study regarding gender and grade level attitudinal differences.

A gender study by Calhoun, Shrigley and Showers (1988) indicated females display significantly different attitudes towards nuclear energy than males, with males having had more positive attitudes. The authors noted that subjects living near nuclear energy plants were generally less positive than those living farther away.

Barrow and Morrisey (1987) found female 9th graders in Maine had significantly different attitudes than male 9th graders, and that geographical location may have a significant impact on attitudes; however, in comparing Maine students with students in New Brunswick, geography was significant in Maine and not significant as a variable in New Brunswick. Perkes' (1973) study was partially substantiated by Barrow, et al.

Burrus-Bammel and Bammel (1988) say there are gender differences on environmental knowledge pretests. Pretests show females tend to have less environmental knowledge. The authors add that girls are shorted in math and science courses, and that when given intensive treatments, a higher quality of instruction and more teacher attention, girls

and boys had comparable levels of knowledge, similar attitudes, and like expectations regarding environmental problems and solutions. Additionally, girls significantly improved on knowledge of the environment when they received treatments designed to compensate for the poor quality of science education that they had previously received. The deficiencies of science education instruction and curriculum discussed by Burrus-Bammel and Bammel, are consistent with concerns expressed by Kuhn (1979), Peterson and Carlson (1979), and Bedwell (1984).

A review of Environmental Education programs by Ham & Sewing (1987/88) supported Burrus-Bammel and Bammel (1988), and suggested that the poor quality of environmental education programs related to the negative attitudes of public school personnel, teachers, and principals regarding the environment. Such negative attitudes in staff generate poor attitudes in students and create curricula deficient in Environmental Education (EE) resources.

In a study by Koballa (1988), the author stated sex was an important etiological variable regarding environmental ideas and attitudes. He added there was no consistent research evidence regarding the effects of science education on attitudes, that a person's background and peer group may affect attitudes, that students become more negative towards science in high school and, as a consequence, develop negative environmental attitudes.

Koballa states that attitudes and behaviors are interrelated. He claimed attitudes denoted a readiness to respond in a certain way, and that beliefs were tied more directly than attitudes to an individual's knowledge base.

Opinions are a combination of attitudes and beliefs, and behaviors are what people actually do. Koballa wrote that weak attitudes may produce weak behaviors, especially in the areas of environmental education or science education. The author asserted that attitudinal research is generally weak--alive but ailing. Finally, Koballa's assertion that attitudes denote a readiness to act is similar to Aristotle's notion of habit (Bambrough, 1965).

In a comparative discussion, Thompson and Gasteiger (1988) said present day students had fewer positive attitudes toward the environment and were less willing to sacrifice than students in 1971; and further, that students in 1981 were more conservative and more materialistic than students in 1971. The authors noted their research showed no significant differences based upon sex but research did show that rural students manifested more environmental concern than urban students. The authors said that liberals in 1971 tended to favor governmental intervention as a means to protect the environment more than liberals did in 1981. The authors also noted that students with higher socioeconomic status were less willing to sacrifice than students of more moderate means. The idea of personal

sacrifice was a critical component in research findings discussed. The authors speculated students in the 1970's were more liberal and more willing to sacrifice than were students in the 1980's.

Findings reported by Thompson and Gasteiger regarding gender were not totally consistent with findings reported by other researchers (Brody, et al, 1987/88; Calhoun, Shrigley & Showers, 1988; Karst, 1985; Kellert, 1985; Barrow and Morrisey, 1987; and Steiner, 1973). Secondly, Hardy and Fox's (1976) findings concerning rural and urban students were the reverse of those reported by Thompson and Gasteiger. Thompson and Gasteiger did seem to partially concur with Borden (1984/85) regarding socioeconomic influences on environmental attitudes and behaviors.

In an article with a similar socioeconomic theme, Strickland, et al (1983/84) stated preschool children's knowledge of energy relates to both parental income and level of education. The authors state that preschool children are more environmentally aware if parents have higher incomes and higher levels of education.

In a summary of research on attitudes, Shymansky and Kyle (1988) said previous research showed that little attitudinal change occurred in students between the ages of 13 and 17. Prior research showed that student attitudes related to levels of student achievement and that females had lower levels of achievement in science than did males.

White students had more interest in science than black students. Home environment, homework, and parental level of education related to student attitudes. Research cited showed that what teachers did in the classroom had little impact on student attitudes. Students with a positive attitude towards science may have needed more positive science experiences to solve scientific and technological problems related to environmental degradation.

Continuing, Shymansky and Kyle said girls were better science students in high school than boys but tended not to enter science vocations. Additionally, girls were more willing to sacrifice career for family, an observation that was consistent with Gilligan's research (1982). Socioeconomic status was related to environmental attitudes. Poor student environmental attitudes related to poor parental attitudes, and educators need to have addressed emotional needs, considering all variables if attitudes were to be positively reinforced by teachers.

The authors asserted that science education research has demonstrated that science instruction met neither the emotional nor the ethical needs of students, a conclusion supported by Bedwell (1984), Burrus-Bammel & Bammel (1988), Kellert (1985), and Koballa (1988). A sociological discussion by Caron (1989) revealed that blacks were just as concerned about the environment as whites, but blacks may differ on issues of concern. Caron found that blacks

with higher levels of education had similar concerns to whites with higher levels of education. Caron suggested that level of education was significantly related to higher levels of environmental concern.

In a post-Chernobyl study by Verplanken (1989), Verplanken asserted that after April, 1986, when one of the nuclear power installations at Chernobyl exploded, attitudes were very strongly affected in fallout areas. In a longitudinal study using the survey method, Verplanken found that people believed nuclear fallout was unsafe. People in the Chernobyl area felt personally threatened and had stronger negative attitudes towards nuclear disasters than persons who had no perception of being in personal jeopardy. Verplanken's conclusions were related to a discussion of the effects of nuclear fallout after Chernobyl by Kerr, et al (1989).

Iozzi (1989) said research findings regarding the relationship between knowledge and attitudes were not clear. He concurred with Pettus (1976) and Koballa (1988). Iozzi suggested that knowledge alone did not change attitudes nor did knowledge alone produce suitable environmental behaviors. Iozzi said research findings sometimes showed a strong positive correlation between knowledge and attitudes and sometimes revealed that negative relationships exist. Research has shown that earlier exposure to Environmental Education may have

produced desirable outcomes in kindergarten to 6th grade students, but in the 8th to 12th grades Environmental Education produced few or no attitudinal changes. In addition, research has revealed that females were more positive towards the environment, urban dwellers were more positive than rural, higher levels of education related to positive attitudes, higher income levels and socioeconomic status related to positive attitudes and high IQ scores related to a positive environmental attitude.

Young educated liberals had more positive attitudes than any other group, Iozzi continued. He stated research has shown that outdoor education and camping experiences may have improved and produced positive attitudes toward the environment. Media could have had a positive influence but may not have done so.

As previously stated, according to Iozzi, EE research has been inconclusive. He said research findings have suggested that educators should emphasize EE at the kindergarten and primary levels using outdoor education and camping designs, and an array of teaching methods to meet student needs in order to create positive attitudes toward the environment, an assertion supported by Collins, et al (1979) and Phipps (1988).

Kuhn and Edgar (1989) claimed that attitudes were multidimensional. Four significant variables emerged in their study of environmental attitudes. They included: 1)

growth and technology, 2) quality of life, 3) relationships between man and nature, and 4) limits of the biosphere. Kuhn and Edgar speculated that persons who are more radically environmental and who do not believe that technology is the solution to our collective problems are Ecocentrists and favor natural solutions to nature's problems. Persons who favor technology are Technocentrists, tending to favor technology rather than conservation as the way to solve environmental problems.

Samdahl and Robertson (1989) said research conducted in the 1970's and 1980's showed that people who were young and well-educated exhibited the most concern for the environment. They said that pro-environmentalists were more likely to live in urban areas and less likely to be farmers.

An unusual study by Burrus-Bammel, Bammel & Kopitsky (1988/89) indicated that past research on attitudes neglected the use of content analysis. They wanted researchers to use content analysis because it was a nonobtrusive way to collect data on attitudes. The researchers asserted that content in environmental literature and environmental publications should have reflected public policies designed to protect the environment. They asserted that a great deal of the literature analyzed was too difficult to read, that Forest Service publications should have shown wild animals (rather

than domestic ones), and that simple prose should have been used to promote environmental understanding and concern. A unique study by Horsley (1988) indicated that anti-littering signs, worded ambiguously, did not significantly alter public attitudes toward the environment, intentions, and behaviors of campers who saw the signs. Horsley believed research should be conducted to discover whether the wording of signs affects attitudes, intent, and littering behaviors.

Phipps (1988), echoing Collins, et al (1979) stated that direct experience was the best way to increase an appreciation of the environment. Such experiences altered cognitive structures, attitudes, and expanded learner skills. For individuals to reach their potentials, they must be allowed the opportunity to experience the outdoors.

Studies cited were sometimes consistent, sometimes unique, and often contradictory. Some studies showed that knowledge, income, background, gender, and grade level related to a high level of environmental concern while others did not. The debate concerning effects of education, gender, age, grade level, and social class on environmental attitudes remains inconclusive based upon research findings cited herein.

Trends and Contemporary Issues

Public policy makers were poorly attuned to the public according to Vining and Schroeder (1989). Vining and

Schroeder noted decisions made by public officials were not based on the attitudes, needs and/or concerns of the public they represented.

Emotions affect decisions and are a general part of cognitive functions. Environmental conflict and scarcity investigations are related to emotions and policy makers should understand public feelings when making environmental plans (Acury, et al, 1990; Baba, et al, 1989; Barber, 1989; De Groot, 1989; Hunsaker, et al, 1990; Reilly, 1990).

Holistically, the scientific community has supported the need for additional environmental research. Jacob Bronowski (1973), a remarkable intellect, made it clear in his book, The Ascent of Man, that all scientific progress was interrelated and that such progress influenced life as we know it. His discussion affirmed the idea that change is a part of life and that all life is interdependent, a point which has sometimes been lost in man's search for energy sources and new technologies. Bronowski declared:

> There are two parts of the human dilemma. One is the belief that the end justifies the means. That push-button philosophy, that deliberate deafness to suffering, has become the monster in the war machine. The other is the betrayal of the human spirit: the assertion of dogma that closes the human mind, and turns a nation, a civilization, into a regiment of ghosts--obedient ghosts, or tortured ghosts. (p.184)

The dogma of unrestrained technological intrusions into the world's ecosystem has been documented in two additional resources, Energy and Conservation (1989) and Preserving World Ecology (1990). Both works included a number of articles on the environment and on the impact of industrial, human, and technological interventions which alarm and alert the reader.

In the first anthology (Long, 1989), ecologists and environmentalists asserted that 90% of our oil will be consumed by the year 2004 using current recovery technologies, and that world oil production will have begun a decline by 2035. The economic effect of the current oversupply is catastrophic. Domestic production in the United States, conservation and a more efficient use of oil could avert crises in our common future. For instance, to conserve we could drive automobiles that require greater miles per gallon; and increment federal, state and/or local taxes using increased governmental revenues to fill our domestic strategic petroleum reserve. We could develop nuclear resources using a theoretical reactor (still being developed), the PIUS (process-inherent ultimate safety) reactor, use the Swedish LWR (light water reactor)--a relatively safe reactor--or the high temperature gas-cooled reactor (HTGR) developed in the United States by GA Technologies in San Diego, California. The GA system has a core which cannot be damaged at all in a melt down,

precluding another Three Mile Island, or even worse, another Chernobyl episode.

Researchers cited in Energy and Conservation (Long, 1989) maintained there is copious evidence that 1,000 years of geo-pressured natural gas is in reserve in the Anadarko Basin in Oklahoma, in Alaska, and the Gulf Coast region of Texas alone. They say the cleanest burning carbon-based energy product is natural gas. Industry has been geared to producing shallower wells, although deep drilling (12,000 t0 15,000 feet) techniques have been used in the Anadarko Basin. After having read about our energy reserves, about safe nuclear reactors that are rarely mentioned in the popular press, and having listened to the national and world debate on energy resources, one can clearly understand the need for environmental research.

In Preserving World Ecology (Anzovin, 1990) environmentalists stressed that all of life has been nested in interdependent systems: cycles of sun, moon, atmosphere, ocean, land, planetary interior, and life itself all interacting with unimaginable complexity and exquisite balance. The Earth life system which scientists call the biosphere, has adjusted itself to changing conditions for the last three billion years. Despite upheavals and extinctions, the basis for life has never been seriously threatened. Now, however, the environment has come to face new challenges that it may not easily

endure--challenges posed by the ecological willfulness and ignorance of humans. Ecologists and environmentalists have been pointing for years to the evidence of waste around us, but we have been slow to grasp that the Earth is not invulnerable, and that we now have the power to damage her beyond repair. (p.7)

Researchers noted an environmental alarm sounded in the 1960's with the work of Rachel Carson. Since that time we have witnessed massive deforestation (Brazil) and desertification (Africa) in dry subtropical countries, intensified flooding in rainy environments, exploitation of forests, largely uncontrolled disposal of urban and industrial waste, appalling housing shortages in both urban and Third World countries, transportation disasters, advances and regressions, the cyanide poisoning of thousands in Bhopal in 1984 and a seasonal ozone hole above the Antarctic. The accumulation of greenhouse gases such as nitrous oxides, carbon dioxide, and methane have contributed to a warmer world.

Finally, we are living in a complex world which techno-optimists say will be saved from harm by scientific progress. Julian Simon and Herman Kahn wholesale a coming Nirvana in which antidotes are provided for all problems. But is Nirvana only a utopian dream (Anzovin, 1990)?

Climatic changes have continued, air pollution has increased even with industrial scrubbers and catalytic

converters, water quality has continued to decline, and soil erosion has been increasing. A contributing factor has been the fact that humans themselves are living longer. Western life expectancies have risen to around 70 years of age, the Chinese have pushed their life expectancy to 70, and longevity in India is around 60. Rising life expectancies tend to mediate the arguments of environmentalists that a holocaust is around the corner. Yet, a rising world population has increased the complexities of maintaining the subtle balance between world and human ecologies. If acid rain has been destroying forests throughout our world, what will be the net effect on rising human populations? If metals, including lead, cadmium and mercury have been returned to the ground in 100 to 10,000 times their natural concentrations what will happen to the earth (Anzovin, 1990)?

There are over 70,000 synthetic chemicals in use today with 500 to 1,000 added each year. Cancer deaths have varied causes but many have been related to cancer-causing chemicals. What are the implications? One family of chemicals that have been particularly damaging are the chlorofluorocarbons (CFCs). CFCs sail into our atmosphere and are released as atoms of chlorine. Chlorine in turn drives a series of chemical reactions that have broken down atmospheric ozone. Chlorine levels have now risen to twice

the natural level. Skin cancers have increased due to less atmospheric protection against radiation. It is known that aerosol sprays, air conditioners, refrigerators and insulated foam products have been the offenders, and yet worldwide production of all of these items has increased since 1984.

The crux of our problem has been us. We have a human population on earth estimated to be 5 billion and expanding at 82 million per annum. We have grown rapidly but as yet do not have the means to check the effects of our growth (Anzovin, 1990). Our students must be able to respond to these involved issues and problems or we, they and our progeny may not have the Nirvana that techno-optimists have predicted.

The infinite complexity of the environment and its interrelationships has been assessed in the context of philosophical indeterminism as expressed by James Gleick in CHAOS, Stephen Hawking in A Brief History of Time or in Joseph Campbell's The Inner Reaches of Outer Space. Chaos theory was the basis of an article in The Wilson Quarterly by Daniel Botkin (1991) in which the author noted chaos theory may well be the theory of the new environmentalism. Botkin stated that theoretically the earth's ecosystem is an immensely complex system. Botkin believed that chaos theory is a model fitting such a complex system and asserted:

> The notion that life and the environment interact is important. The traditional view in science is that the Earth changes slowly and evenly, and is very little affected by life.... after all the total mass of all living things on Earth is a tiny fraction - two-tenths of one part of one billionth - of the mass of the planet.... Nature as we are coming to know is a patchwork of complex systems with many things happening at once...undergoing changes at many scales of time.... Chance events seem to play an important role. (p. 70)

The old Earth as a machine metaphor has remained useful according to Botkin because we can still use notions of cause and effect to analyze discrete systems. According to Botkin, however, we grew up in simple times with simple models. Our children who are products of a more complex computer based culture may be more intuitively familiar with the issues chaos theory presents. They may be more familiar with complexity and dissonance than we, and they may find indeterministic paradigms more useful than deterministic paradigms in assessing and solving environmental problems.

The idea of environmental complexity has been supported in articles by numerous authors in a recent issue of Environmental Science and Technology. For example, Kimbrough (1990) believes newly gained scientific knowledge

of the environment has not been incorporated into current environmental laws in the United States. Our enforcement of laws has been regionally based, with programs and regulations regionally developed and to a large degree controlled by interest groups.

On another tack, Callis (1990) said polls indicated that only 5% of adult Americans claimed to have an understanding of basic scientific concepts or issues of scientific policy, 70% of Americans wanted to curb scientific activity, and half of 17 year olds believed science is not useful. Callis called for a new ethic to promote science and an understanding of our world; he also called for more research and a rational political process.

In a more limited discussion, Cortese (1990) said air is a resource that is essential to all life. Cortese noted that respiratory illness and pollution were tied together in Donora, Pennsylvania in 1948 and in London in 1952, which made it evident that air pollution has become a major blight of industrial societies. Cortese cautioned that past efforts, since Earth Day 1970, have reduced particulates, carbon monoxide, and more modestly, sulfur dioxides and volatile organic compounds (VOCs), but have failed to attenuate nitrogen oxides due to increased automobile emissions. He explained that air pollution has ceased to be a regional problem but has become a world health problem. In China, 28 cities exceeded World Health

Organization (WHO) guidelines for particulate and sulfur dioxide levels. Twenty million residents of Mexico city breathed ozone at levels more than 50% above WHO guidelines. Whole forests have been destroyed in Eastern Europe by sulfur dioxide emissions.

Cortese looked into our collective future and predicted a world population of 10 to 12 billion by the year 2030 with 90 percent of the population living in cities and the Third World. By the year 2000 we will have made 500 million additional automobiles. Although the U.S. and other Western countries will have substantially decreased toxic emissions, overall toxic and harmful emissions will have increased due to increased numbers of people and an increased need for transportation.

Individual domiciles, increasing energy demands in cities, and the use of fossil fuels, have all been contributing factors to an immensely complicated problem. Cortese believed we can change if we (1) provide monetary incentives for conservation and efficiency, (2) use more mass transportation and fewer cars as individuals, (3) substitute natural gas for coal to reduce carbon dioxide emissions and acid rain and (4) use technology to control emissions from homes, cars and industrial sources. In related articles, Houghton (1990) said global deforestation included an "irreplaceable loss of species, the alteration of land ... with diminished capacity to support crops ... a

change in the water cycle, heat balance and climate of Earth." (p. 414) Goldberg (1990) asserted that oceans, like Houghton's forest, are being destroyed by man. He says we really do not understand the effects of mariculture, ocean waste disposal, the use of oceans for recreation, and transportation. What does occur when we harvest seaweed, shrimp, and salmon in the millions of tons? Goldberg argues, the oceans are our wet commons and should be protected for the benefit of all. Hoffman, et al (1990) were concerned with the effects of pollutants on wildlife habitats. They said even in ancient times men were aware of the condition of wild birds. They concluded regulations to protect endangered species and habitats are needed.

In a kindred discussion, Blum and Speece (1990) were concerned with the impact of wastewater on aquatic species in terms of toxicity of such wastewater. Such toxicity they felt might be a threat to both man and fish. Additionally, Schneiderman and Carpenter (1990) called for agricultural research that evolves as world population increases. They noted the Tigris-Euphrates Basin sustained a stable large population for 5,000 years and wondered how agriculture can sustain a nearly Malthusian population contemporarily. Schneiderman and Carpenter called for increased research and more productive and ecologically beneficial agricultural techniques. Regarding humans, Lioy

(1990) said history reveals that we humans have been exposed to toxins over time. In the 1600's in London the citizenry lived with "fumifugium;" there was the British cholera epidemic in the 1840's associated with drinking water contaminated by raw sewage, the Donora and London air pollution episodes of the 20th century, black lung disease, the methyl diisocyanate explosion in Bhopal, India, asbestos and Legionnaires' disease. He said many scientists in many disciplines have conducted research in the past 10 to 15 years and that in order to assess problems adequately multidisciplinary teams are needed. A database needs to be developed so that teams can tap into resource information to assess the effects of toxins on humans and identify populations that are at risk.

Reilly (1990), recalling Earth Day 1970, said we need to be as concerned today. We need to make environmentally sound decisions. We need a renewed commitment to the environment that will prevent waste and pollution to protect our common environment.

As Boly (1991) reminded us, Europe is not only at risk but many Soviets live in a wasteland created by fallout from Chernobyl. Chernobyl scattered a witch's brew of hot particles to the four winds. Some scientists estimated that up to 80 percent of the radiation Soviet citizens are getting is from contaminated food and drink. Following the accident the government withdrew four thousand square miles

of contaminated farmland from production. Western governments and advisors have focused on the number of "extra" cancer deaths. Conclusions range from fewer than a thousand to more than a quarter of a million. (p. 65)

Jefferson (1991) argued environmentalists have been guided more by emotion than by science. He noted the "Big Green Ballot" in California was recently defeated and that we need to generate economically practical solutions to environmental problems. To illustrate, he pointed out that environmental purists wanted to recycle everything, all of the time, regardless of the need or the cost. Jefferson said it made sense to recycle aluminum and steel if it is cost effective to do so, but to do so because of politically correct environmental agendas regardless of expense is absurd. Additionally, Jefferson claimed not all scientists believe in, support or advocate theories such as global warming and the Greenhouse Effect as environmentalist radicals would have the public believe. Nor did Jefferson believe there was scientific consensus about such theories. He said we could deal with our problems sanely, that we in the U.S. now have enjoyed the cleanest environment in the world, that we have a better lifestyle than any other people and more liberty than any other people. Jefferson feared radical environmentalism could transcend international boundaries, transcend our individual rights and liberties, and could gain enough

power to run the world its own way. In essence, the environmental political party would stop the use of all fossil fuels, would limit population and would ultimately oppress all environmental nonpurists if it took control of our polity and political system.

Clemings (1991), in a more traditional environmental discussion, noted that 60 million hectares of irrigated land have been put in danger in the world. For instance, the lower end of the Colorado River has filled with salts and water used to flood fields has killed the soil due to salinity. Clemings felt we could recoup losses in agricultural lands in both the U.S. and Mexico if we used alternative irrigation--drip irrigation and plastic tubing rather than flooding of fields.

Birds were the topic in Miller's (1991) article on the destruction of golden-cheeked warbler habitats in Texas. The author asserted the burgeoning populations in suburbs around Austin and the Hill Country areas surrounding Austin have caused a type of deforestation that is a danger to the warbler since warblers nest only in mature cedars that are at least 40 to 50 years old. Such destruction, Miller said, only demonstrates our own avarice and immaturity.

According to Pope (1991), we war on Earth when we sacrifice the Earth for a single resource. Pope reminded us that the Mongols savaged their world to acquire grass, a single resource, for their multitudinous horses. Americans

likewise have risked an entire ecosystem to maintain a supply of oil.

Pope has suggested we fought the Iraqi war for oil, and the Mongols raided far and wide for grass. Times and resources change, yet given the magnitude of modern man's destructive resources, can we continue to fight wars without a protocol that prohibits the targeting of ecosystems? In the aftermath of the Persian Gulf War, over 500 Kuwaiti oil wells were aflame and spewing millions of barrels of oil onto the Earth and into the Gulf. By comparison the Exxon Valdez was a microspill. Environmentalists can no longer ignore the effects of war on the environment. Action must be taken to prevent the ruin of ecosystems.

Moberg and Cohn (1991) in an autobiographical account of Rene Dubois, a renowned scientist and environmentalist, portrayed Dubois as a scholar who moved from pure research to philosophy. The authors stressed that Dubois became attracted to philosophic necessity when confronted with three concepts involving microbes. One concept suggested to Dubois that all life is interrelated and that environments affected activities of living organisms. Consequently, Dubois came to believe that "any living organism possesses multiple potentialities; the one it expresses depends on external influences." (p. 70)

Dubois' approach to the environment was to promote health. Health, according to Dubois, was not necessarily a state of vigor and well-being, not even long life. To be healthy did not mean that one was free of all diseases; but rather it meant that one could function, do what was desired to do and become what one wanted to become. (p. 73)

Dubois was no doomsayer. He introduced a human context and demanded changes in the way people think and live. Dubois noted there was no natural ecology since man has changed everything. Dubois' epigram, "Think globally, act locally," is a challenge to those who want to preserve the global habitat by encouraging activism at the local level. Perhaps such individual action is best reflected by Emerson, the quintessential individual, who wrote,

> But the craft with which the world is made runs also into the mind and character of men. No man is quite sane; each has a vein of folly in his composition, a slight determination of blood to the head, to make sure of holding him hard to some one point which nature had taken to heart. Great causes are never tried on their merits; but the cause is reduced to particulars to suit the size of the partisans, and the contention is ever hottest on minor manners. Not less remarkable in the overfaith of each man in the importance of what he has to do or say. The poet,

> the prophet, has a higher value for what he utters than any hearer, and therefore it gets spoken. (p. 392)

Implications

All resources cited are mediated on behalf of the idea that any study of the environment, however limited, must be considered in context of history, philosophy, education, science, and our global interrelatedness. Solutions to our complex environmental problems may take the collective power of all researchers, of all humanity, or perhaps an environmental Einstein to generate a solution (Botkin, 1991). The magnitude of environmental problems, issues, discussions, and environmental research, by implication, limit this study.

CHAPTER III

METHOD

Population

This study used both a descriptive approach and a statistical approach to assess the sample in context of research hypotheses and questions. Information accumulated in the study was used to describe a representative sample of high school students in the Permian Basin Region of Texas. More specifically, the student sample consists of 482 students, both male and female, both 10th and 12th grades, from 11 high schools located in the Permian Basin Region of Texas.

Students were asked to participate by principals and/or their designees in selected schools in the Permian Basin Region. Additionally, curriculum surveys were sent (given) to all districts in the Permian Basin Region. Participating high schools were listed in a survey generated by the Texas Education Agency (Texas Education Agency, 1989). Participating public school districts and public high schools were selected using the same resource.

Instrumentation

Three methods were used to gather data for this research effort.

1. To test student knowledge and student attitudes toward the environment, the researcher used the "Environmental Knowledge and Attitude Inventory." Measures of validity and reliability were established by Perkes (1973). Several environmental fact and attitude items were updated.

2. Principals and/or their designees were asked to fill out a data collection component indicating the total population of the high school participating in the study, total number of 10th graders, total number of 12th graders, and authorization of permission to participate in this study (See Appendix D).

3. All thirty-one public school districts with senior high schools received a survey regarding their environmental education programs. Surveys were completed by school district superintendents or designees. Seventeen districts returned the survey (See Appendix B).

Research Design

This study was designed to statistically measure environmental knowledge levels and environmental attitude levels of 10th and 12th grade students. Secondly, the study was designed to assess the state of environmental education curricula in the Permian Basin Region of Texas. To accomplish the first goal of this study, inventories were mailed (given) to eleven participating high schools in the Permian Basin. Instructions for students were included

on all student inventories (See Appendix A). Instructions for test administration were sent to all test sites in all selected high schools (see Appendix D). Additionally, inventory packets included: return mailing labels, return mail meters, sharpened pencils, cover letters (see Appendix C), scantron cards, and return envelopes for scantron cards and student inventories. Prior to sending materials, each participating school was contacted by the researcher to obtain confirmation of authorization to conduct the study. Materials were sent after authorization was confirmed with the principal at each participating public high school.

The Region XVIII Education Service Center (Region 18 Schools, 1990/1991) provided a public school district address and telephone directory including all 31 Permian Basin public schools with the names of all superintendents, principals and other relevant data. Two school districts have no high schools and consequently were eliminated from this study. Eleven public high schools agreed to participate and have returned materials. One high school returned materials for the 10th grade only and a total of three high schools required a second contact before materials were returned.

Students in the study included 10th and 12th grade students at large, mid-sized and small high schools. Both male and female students were included in this study. To assess environmental education curricula in the Permian

Basin Region of Texas, a brief questionnaire regarding curricula was mailed (given) to all 31 school districts with high schools in the region. In Midland, surveys were completed by the researcher as the principal's designee.

Data Analysis

All environmental knowledge and attitude information in this study is taken from a representative student sample. Students inventoried indicated school size, their gender, their grade level, and class on their inventories and/or scantron cards (See Appendix D).

Students were asked to complete all knowledge and questions on the "Environmental Knowledge and Attitude Inventory." Scantron cards completed incorrectly were eliminated from this study.

To reiterate, data gathered in this study was assessed using descriptive and statistical measures which included an Analysis of Variance and a Pearson Product Moment Correlation. Tables have been included to display significant inventory statistics. A second component of this study involved an environmental education curricula survey (Appendix B) of public school districts with high schools in the Permian Basin Region of Texas.

CHAPTER IV

RESULTS

The first purpose of this study was to measure student levels of environmental knowledge and attitudes in the Permian Basin Region of Texas. The second aim was to assess the state of environmental education in the Permian Basin Region. The results of this study have been presented in four sections. The first section contains a statistical overview of the participating high schools using a descriptive format. The second section gives a measure of differences between means, an ANOVA, to analyze Research Hypotheses 1 through 6. The third section uses a correlational measure of relationships, the Pearson Product Moment Correlation, to assess Research Hypothesis 7 and the final portion of this chapter presents the results of the environmental education curricula survey.

Descriptive Statistics: An Overview

Although levels of significant differences or measures of significant relationships were not found using a descriptive format or approach, such descriptive statistics did provide a basis for understanding obvious differences or similarities in student samples taken from the large, mid-sized, and small high schools included in this study.

For the purpose of this research, high schools were divided into three subgroups. Group 1 consisted of small high schools and included 1A and 2A high schools (Table 2). Group two consisted of mid-sized high schools and included 3A and 4A high schools. Group 3 consisted of large 5A high schools. In this study there were four small high schools, four mid-sized high schools, and three large high schools. In the eleven participating high schools, 482 students took an environmental knowledge and attitude inventory. The sample included 244 boys, 238 girls, 273 tenth graders and 209 twelfth graders (See Table 4). Participants were selected by the principal or a principal's designee, and included World History, English, Physical Science, Psychology, Economics and Physics students in the 10th and 12th grades. Tables 1 through 3 provide a descriptive overview of the high schools, student sample, and population. Subsequent descriptive tables provide information about the sample and include means, standard deviations, and the number of students in each high school for the subgroups evaluated and for the total sample. Environmental knowledge means indicated the average number of correct responses on the environmental knowledge section of the inventory administered. Environmental attitude means indicated the number of "I agree" responses students made on the attitudinal section of the inventory (See Appendix A).

Table 1

Participating High Schools

Group 1	N
2A High Schools	
Forsan H S	29
Stanton H S	52
1A High Schools	
Valentine H S	09
Buena Vista H S	23
Total 2A & 1A	113
Group 2	
4A High Schools	
Big Spring Sr. H S	20
Ft. Stockton Sr. H S	43
3A High Schools	
Greenwood Sr. H S (Greenwood)	39
Alpine Sr. H S (Alpine)	87
Total 4A & 3A	189
Group 3	
5A High Schools	
Robert E. Lee Sr. H S (Lee)	73
Odessa Sr. H S (Odessa)	60
Midland Sr. H S (Midland)	47
Total 5A 180	
Total Sample All High Schools	482

For the total number of students sampled in each high school, by subgroup, and for the total sample taken in all eleven high schools see Table 1.

As indicated in Table 1, in the subgroups assessed, the small high school sample consisted of 113 students, the mid-sized high school sample equaled 189 students, and the large high school sample contained 180 students for a total sample of 482 students.

In Texas the UIL conference rules divide schools into appropriate classifications based upon enrollments for particular school years. In the school year 1990-1991, the year in which this study was conducted, high school conferences for the UIL were divided as stated in Table 2.

Table 2

Conferences and Subgroups

Large	Conference 5A	1,460 and up
Mid-Sized	Conference 4A	690 to 1,459
Mid-Sized	Conference 3A	285 to 689
Small	Conference 2A	140 to 284
Small	Conference 1A	139 & below

(UIL, 1990-1991)

As Table 2 indicated large high schools were those with a student population exceeding 1,460. Mid-sized high

schools were those with a range of students from 285 to 1,459. Small high schools ranged from 139 or below to a maximum of 284 students. In this study high schools were categorized as indicated in Table 2.

There were thirty-one public schools in the Permian Basin Region offering high school classes at the 10th and 12th grade levels. There were thirty-three public school districts. Two districts offered only elementary classes and/or junior high classes and were excluded from this study.

The thirty-one districts that had high school classes differed in programs offered. Twenty-six districts offered comprehensive high school programs. Five districts offered all grades in their schools (K - 12). All participating high schools were sent a preliminary participation request form, a data collection component (See Appendix D), were contacted by telephone and/or were contacted personally by the researcher. Of the thirty-one possible high schools, eleven high schools (36%) agreed to participate in this study and have returned materials. For a breakdown of participating students by grade levels 10 and 12 and for the total populations in each high school and in this study (see Table 3).

Table 3

Samples and Total Populations by High School Breakdown By Grade

	Grade Level 10	Grade Level 12	Grade Levels 10 & 12	High School Populations
R. E. Lee	40	33	73	1,878
Odessa	30	30	60	2,015
Midland	29	18	47	1,527
Alpine	48	39	87	325
Greenwood	19	20	39	1,289
Big Spring	20	00	20	1,051
Ft. Stockton	23	20	43	810
Stanton	29	23	52	210
Forsan	15	14	29	120
Buena Vista	15	08	23	35
Valentine	05	04	09	19
Total	273 Sample	209 Sample	482 Sample	8,830 Population

As stated previously, by gender, 244 boys participated in this study as compared to 238 girls. As Table 3 shows, 273 tenth graders participated compared to 209 twelfth graders. The total sample included 482 students, and the

total population in participating high schools included 8,830 students. The number of students, means, and standard deviations for large, mid-sized, and small high schools are displayed in Table 4. Although no research hypotheses could have been accepted or rejected using simple descriptive statistics, a display of means and standard deviations did allow the researcher to develop a qualitative overview. Mean scores and standard deviations for the entire sample of 482 students are displayed in Table 4 by gender, grade level, school size, and total levels of environmental knowledge and attitude.

Table 4 - All High Schools

Environmental Knowledge and Attitude by Grade, Gender, and School Size

Environmental Knowledge	Mean	SD	N
Male	8.7869	2.9221	244
Female	8.4748	2.5716	238
10th Grade	8.8059	2.8159	273
12th Grade	8.4067	2.6661	209
Small High Schools	8.6991	2.9727	113
Mid-Sized High Schools	8.4921	2.8315	189
Large High Schools	8.7389	2.5355	180
All High Schools	8.6328	2.7562	482

table continues

Environmental Attitude	Mean	SD	N
Male	7.3156	2.6346	244
Female	7.3529	2.3799	238
10th Grade	7.2784	2.4001	273
12th Grade	7.4067	2.6498	209
Small High Schools	7.3274	2.7171	113
Mid-sized High Schools	7.4603	2.5148	189
Large High Schools	7.2056	2.3723	180
All High Schools	7.3340	2.5095	482

As Table 4 shows, means and standard deviations for the total sample were remarkably alike. The trend of similarity found in each subgroup was more pronounced for the sample as a whole. Descriptive indicators showed the subgroups to be more similar than dissimilar. Histograms indicated that the distribution of responses was relatively normal distribution for students inventoried (See Appendix F). Scatterplots indicated that groups compared showed some relationship between environmental knowledge and environmental attitudes (See Appendix G).

Analysis of Variance: Hypotheses 1 - 6

The initial portion of this section includes an analysis of significant differences in student

environmental knowledge levels based upon student gender, student grade level and the size of high school that a student attends (Research Hypotheses 1 - 3). The second part of this subsection includes an evaluation of differences in student environmental attitudes based upon student gender, grade level and the size of school that a student attends (Research Hypotheses 4 - 6). To test for differences among group means, the researcher used a statistical package to generate Analysis of Variance measurements. Research Hypotheses 1 - 6 were evaluated using an Analysis of Variance measure to generate an F statistic and to find probability levels. In this study, the Analysis of Variance measure functioned like a t-test.

Table 5

Analysis of Variance: Environmental Knowledge - Gender

Gender	N	Knowledge Means	DF	MS	F	Prob
Male	244	8.7869	1	11.7353	1.5465	0.2143
Female	238	8.4748	480	7.5881		

Not significant at the .05 level

Evaluating significance differences in student environmental knowledge means based upon the gender of students participating in this study was the focus of Research Hypothesis 1. Table 5 displays statistics found

regarding Research Hypothesis 1. An ANOVA was used to test for differences among group means.

As Table 5 indicates there were no significant differences between group means tested at the .05 level of significance for the total sample of male and female students in the Permian Basin Region.

Based upon the F statistic found and the probability level calculated, the Null Hypothesis has been accepted in this study. An analysis of student environmental knowledge level and grade level effects on mean scores was the focus of Research Hypothesis 2. Statistics pertaining to Research Hypothesis 2 are displayed in Table 6.

The question addressed in this research inquiry was whether or not there were significant differences in environmental knowledge levels of students in the 10th and 12th grades in the Permian Basin Region of Texas. To assess differences, an ANOVA was used to test for differences among group means for the 273 tenth graders and 209 twelfth graders participating in this study. Statistics regarding the hypothesis measured are displayed in Table 6.

The Null Hypothesis has been accepted based on the level of probability shown in Table 6. Consequently, there were no significant differences based on grade level means found at the .05 level of significance for 10th and 12th grade level students in the Permian Basin Region of Texas.

Table 6

Analysis of Variance: Environmental Knowledge - Grade

		Knowledge				
Grade	N	Means	DF	MS	F	Prob
10th	273	8.8059	1	18.8608	2.4905	0.1152
12th	209	8.4067	480	7.5732		

Not significant at the .05 level

The third major question addressed in this study involved a test of group means to discover whether or not there were any differences among student environmental knowledge means based upon the size of school that a student attends. In this study, high schools were separated into three distinct groups: large high schools, mid-sized high schools, and small high schools (see Table 2). Eleven high schools participated in this study. Those 11 high schools included three large high schools, four mid-sized high schools, and four small high schools (See Table 1). In total numbers, subgroups consisted of 113 small high school students (Group 1), 189 mid-sized high school students (Group 2), and 180 large high school students (Group 3). Differences among means for the three subgroups were tested using an Analysis of Variance to produce test statistics. Statistics regarding size of school differences in group means are displayed on Table 7.

Table 7

Analysis of Variance by Group: Environmental Knowledge - School Size

		Knowledge				
Size	N	Means	DF	MS	F	Prob
Small	113	8.6691	2	3.1331	0.4114	0.6629
Mid-sized	189	8.4291	479	7.6155		
Large	180	8.7389				

Not significant at the .05 level

As shown in Table 7, there were no significant differences among subgroup means at the .05 level of significance in the sample inventoried in this study. Therefore, the Null Hypothesis has been accepted in this study.

Research Hypothesis 4 was the first of three hypotheses in which environmental attitude levels of students were compared. Specifically, Hypothesis 4 assessed student attitudinal differences based upon gender. In this study, 244 males and 238 females were inventoried for a total sample of 482. To test for differences among the two groups, males and females, an ANOVA was used. The F statistic, related statistics and probability level obtained with regard to Hypothesis 4 are shown in Table 8.

Table 8

Analysis of Variance: Environmental Attitude - Gender

Gender	N	Attitude Means	DF	MS	F	Prob
Male	244	7.3156	1	0.1682	0.0267	0.8704
Female	238	7.3529	480	6.3105		

Not significant at the .05 level

As the probability level in Table 8 shows, there were no significant differences in sample means at the .05 level of significance. In this study, male and female students did not display significantly different environmental attitudes. Attitudinal mean scores reflected "I Agree" responses on the inventory administered to students (See Appendix A).

In the following portion of this analysis, differences in student attitude means based upon grade level were measured. In this study, 273 tenth graders and 209 twelfth graders were inventoried. Grade level statistics are presented for Hypothesis 5 in Table 9.

Table 9 indicates that there were no significant differences among environmental attitudes for 10th and 12th grade students inventoried and assessed in this study. The level of probability exceeds .05, and consequently the Null Hypothesis has been accepted as stated in this study. The

final attitudinal hypothesis, Research Hypothesis 6 is assessed in the following section.

Table 9

Analysis of Variance: Environmental Attitude - Grade

		Attitude				
Grade	N	Mean	DF	MS	F	Prob
10th	273	7.2784	1	1.9489	0.3090	0.5785
12th	209	7.4067	480	6.3068		

Not significant at the .05 level

The research question on which Hypothesis 6 focused was whether or not there are significant differences in student attitudes based upon the size of school that a student attends. In this subsection, an Analysis of Variance measure was used to compare groups. Relevant statistics are shown in Table 10.

Table 10

Analysis of Variance: Environmental Attitude - School Size

		Attitude				
High Schools	N	Means	DF	MS	F	Prob
Small	113	7.3274	2	2.9951	0.4745	0.6225
Mid-sized	189	7.4603	479	6.3115		
Large	180	7.2056				

Not significant at the .05 level

The level of probability shown in Table 10 reveals no significant differences among student environmental attitude means based upon the size of school that a student attends. Given a level of significance of .6225, the null has been accepted in this study.

One of the major purposes of this study was to assess the environmental knowledge and attitude levels of 10th and 12th grade high school students in the Permian Basin Region. To test the relationship between environmental knowledge levels and environmental attitudes, a Pearson Product Moment Correlation was used to statistically evaluate the strength of the relationship between student environmental knowledge levels and student environmental attitude levels.

Four correlations were found. Three correlations were found for the three subgroups, e.g., for large, mid-sized, and small high schools in the Permian Basin Region. One correlation was found for the total student sample and includes all 482 students. Table 11 displays statistics for each subgroup and Table 12 shows correlational results for the total sample.

As Table 11 indicates there was a significant relationship between environmental knowledge levels and environmental attitude levels of students inventoried in the mid-sized school subgroup. In context of the research question, the null hypothesis was rejected for mid-sized

high schools alone; however, to justify acceptance or rejection of the null hypothesis for the total sample a correlational statistic for the total sample was found and is shown in Table 12.

Table 11

Correlations: Environmental Knowledge & Attitude

Subgroup	N	r	Prob
Large HS	180	0.0888	0.118
Mid-size HS	189	0.2145	0.001*
Small HS	113	-0.0573	0.273

* Significant at the .05 level

Table 12

Correlation: Environmental Knowledge and Attitude

Group	N	r	Prob
All Cases	482	0.0977	0.016*

* Significant at the .05 level

As indicated in Table 12, there was a significant relationship at the .016 level between student environmental knowledge levels and attitude levels in the Permian Basin Region among the 482 students inventoried in eleven high schools in the area. Given the strength of the correlation between environmental knowledge and attitudes

for the total sample, the Null Hypothesis has been rejected as stated in Hypothesis 7.

Additional Research Question

In response to Research Question One, how have school districts in the Permian Basin Region integrated environmental education into the public high school curriculum? Superintendents or their designees provided the following information in our curriculum survey (see Appendix E).

Seventeen of 33 school districts (52%) responded to the curriculum survey. Of the 18 surveys returned, seventeen school districts responded in the affirmative, one district returned 2 surveys, and one school district indicated that no environmental education was being offered. Results of the curriculum survey are shown in Table 13.

As indicated in Table 13, fourteen school districts (42%) do offer or are piloting a form of environmental education at the high school level. There are 32 high schools in the Permian Basin that could offer Environmental Education in the curriculum, 16 high schools (50%) have offered environmental education. A single high school (03%) offered no program of environmental education at the secondary level. Two school districts with two high schools (06%) that responded offered such environmental education instruction only in junior high or in K - 6 and a

middle school. Of the total survey respondents, 84% offered environmental education or in 16 of 19 possible high schools. If survey responses were any indication of the magnitude of environmental education offerings in the Permian Basin Region from an environmental education point of view, the results of this study were positive.

Table 13

Environmental Education Curriculum in the Permian Basin Region

Environmental Curriculum Offered In High School?	
Yes = 14 School Districts	No = 3 School Districts
Yes = 16 High Schools*	No = 3 High Schools

* Two of the responding school districts have two high schools; the other districts have only a single high school.

CHAPTER V

SUMMARY, FINDINGS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Summary

The primary purpose of this research effort was to assess environmental knowledge and attitude levels among a sample of 10th and 12th grade, male and female students from small, mid-sized and large high schools in the Permian Basin Region of Texas. An additional research question addressed in this study was to evaluate the state of environmental education in the Permian Basin Region of Texas. The researcher utilized an environmental knowledge and attitude inventory (Appendix A) and a survey of school districts in the Permian Basin Region to obtain raw data. Analysis of data involved the use of descriptive statistics, an Analysis of Variance, and the Pearson Product Moment Correlation. Measurements and methods used are both qualitative and quantitative.

Average or mean scores and standard deviations were computed for all subgroups and for the total sample with regard to environmental knowledge and attitudes. All means and standard deviations were displayed (Table 4) for each subgroup and for the total sample in an effort to give a

descriptive overview of students by gender, grade level, and size of school which students attended. All statistics used were derived from a statistical package, Statpal (Chalmer & Whitmore, 1986).

Histograms and Scatterplots (Tables F & G) were run prior to generating F statistic using an Analysis of Variance measure to test differences in group means for Research Hypotheses 1 - 6. Such descriptive information gave the researcher a descriptive overview of variables assessed (see Appendices F & G).

Analysis of Variance results were consistent with preliminary descriptive analysis conducted by the researcher. To illustrate, if one looks at Table 4, means and standard deviations for the sample as a whole and for subgroups were similar, indicating a priori that groups are alike. A test for statistical differences between group means using an F Statistic and associated levels of probability showed that no differences between means for the sample measured are significant at the .05 level of statistical significance validating insights provided by looking at means and standard deviations.

The most significant relationship found in this study was the significant positive relationship between environmental knowledge and attitudes (Tables 11 & 12) for both mid-sized high schools and for the total sample.

Scatterplots (Appendix G) revealed a priori that in a qualitative sense such a relationship existed.

Survey materials indicated that although quite diverse in approach, a majority of the school districts that returned surveys were concerned about environmental issues. Thus, of the schools surveyed, knowledge of the environment was in an area or topic demanding either a specific course in a curriculum or the integration of environmental issues into biology, physical science, earth science, environmental science and/or social studies units of study or lessons.

The inventory used to collect data was a modified form of Perkes' (1973) inventory of student environmental knowledge and attitude levels developed by Hardy and Fox (1976) (see Appendix A). The survey used was developed by the researcher with the guidance of his doctoral committee (see Appendix B).

Surveys were sent to all high school superintendents in the Permian Basin with the exception of the Midland Independent School District, in which the researcher resides. In Midland, teachers and principals were interviewed to acquire population data (Appendix B) and curriculum information (see Appendix E).

Findings

1. There were no significant differences between environmental knowledge levels based upon student gender found in this study.

Perkes (1973) found that males achieved a significantly higher score than females on the environmental inventory administered. Thus, the results of this study for all high schools combined are not consistent with Perkes' (1973) findings.

2. There were no significant differences between environmental knowledge levels based upon student grade level found in this study.

Perkes (1973) indicated that 12th graders scored significantly higher than 10th graders on the total knowledge score. Findings for all high schools participating in this study do not support those of Perkes.

3. There were no significant differences found between environmental knowledge levels based upon the size of school attended by the students used in this study.

Perkes found no significant relationships between community size and student level of environmental knowledge.

4. There were no significant differences between environmental attitude levels based upon student gender found in this study, a finding that is consistent with Perkes (1973).

5. There were no significant differences between environmental attitude level based upon student grade level found in this study, a finding supported by Perkes.

6. There were no significant differences between environmental attitudes based upon the size of school that a student attends.

Hardy and Fox (1976) found that there was a significant difference in attitude means for three student subgroups: urban, suburban, and rural.

7. There were significant positive relationships between student environmental knowledge levels and student environmental attitude levels found in this study within the mid-sized subgroup and for the total sample.

Research Hypothesis 7 is closely tied to Hardy and Fox's (1976) study of urban, suburban, and rural students. In that study the researchers explored the possibility of a relationship between environmental knowledge and attitudes among subgroups and found that such a relationship existed for urban and suburban subgroups.

Findings in this study indicate that there is a strong positive relationship (.001) between environmental knowledge and attitudes among students in mid-sized schools. Secondly, findings herein show a strong positive relationship (.016) between student environmental knowledge and student environmental attitudes for the entire sample. The findings of this study tend to support Hardy and Fox's

(1976) examination of such a relationship among students in urban, suburban, and rural areas and lend support to their call for an environmental education curriculum that teaches positive environmental attitudes especially when the additional research question addressed in this study is considered in the following.

An additional research question considered in this study was, "How and to what extent have selected school districts in the Permian Basin Region of Texas integrated environmental education into the high school curriculum?" It was found that a majority of districts surveyed have implemented a form of environmental education into their respective high schools. If they have done so in a positive fashion then Hardy and Fox's wish for positive values transmission in this area may have been sustained. In reading survey responses (see Appendix E), there seems to be no reason for pessimism.

Recommendations for Future Research

The present study is based on an interest in the relationship of student environmental knowledge levels and environmental attitude levels.

1. One attractive study for future consideration would be to replicate and broaden this study, collecting data from Texas and adjacent states and concentrating on the area of attitudinal differences while comparing students at all grade levels.

2. A second study would be to measure levels of knowledge for all grade levels and compare differences between all grade levels in Texas and adjacent states.

3. A third study would be to use a Keeling curve approach in which student levels of knowledge and attitudes are measured longitudinally using the same high schools and representative or random samples from the same selected high schools on a year-to-year basis.

4. A fourth study in which a modified inventory could be used would be one using an experimental design and a pre/post-test format to test the impact of a specific environmental curriculum.

In this design, student levels of knowledge and student levels of attitude could be tested before and after a treatment or series of treatments to discover whether such treatments caused any change in either student environmental knowledge or attitude levels.

5. A fifth study would broaden the parameters of the curriculum survey used in this study and send a similar survey to gather data about the state of environmental education in Texas and in other regions of the United States.

6. A final study would be to test long term effects of treatments by focusing on high schools that offer an environmental education class and checking to see before students take the class and several years after they have

taken the class to see whether environmental knowledge levels and attitudes levels differ from the general population.

APPENDIX A:

ENVIRONMENTAL KNOWLEDGE AND ATTITUDE INVENTORY

"Environmental Knowledge and Attitude Inventory"

Environmental Knowledge

1. The U.S. population is growing at a rate which is
   *____(a) less rapidly than most of the world.
   ____(b) at the same rate as the rest of the world.
   ____(c) more rapidly than the rest of the world.
2. What percent of the Nation's population is served by adequate sewer and treatment plants?
   ____(a) more than 90%
   ____(b) more than 70%
   ____(c) about 50%
   *____(d) less than 40%
3. The Environmental Protection Agency estimates that industry can currently remove approximately what percent of pollution discharged into water.
   ____(a) 100%
   *____(b) 85%
   ____(c) 65%
   ____(d) 50%
4. North Americans are removing fresh water from underground resources
   ____(a) half as fast as it is being replaced
   ____(b) at about the same rate as it is being replaced
   *____(c) twice as fast as it is being replaced
   ____(d) four times as fast as it is being replaced
5. The major air pollutant discharged into the air by weight is
   ____(a) nitrogen oxide
   ____(b) sulfur oxide
   ____(c) particulates
   *____(d) carbon monoxide
6. The known supply of coal is estimated to be adequate for
   ____(a) 3 years
   ____(b) 30 years
   *____(c) 300 years
   ____(d) 30,000 years
7. The population of the world increased from about 2 billion in 1930 to about
   ____(a) 2.5 billion by 1990
   ____(b) 3.5 billion by 1990
   ____(c) 4 billion by 1990
   *____(d) 5 - 6 billion by 1990
8. Most solid waste (s) are produced by
   ____(a) industry
   *____(b) residential operations
   ____(c) commerce
   ____(d) agricultural operations
9. The largest amounts of usable phosphates that reach bodies of water come from
   ____(a) municipal sources
   ____(b) industrial sources
   *____(c) agricultural sources
   ____(d) maritime sources
10. An inversion can be harmful in that it

____(a) increases carbon dioxide in the air
*____(b) causes pollution to stay near the ground
____(c) reduces horizontal air movement
____(d) sweeps away pollution

11. At present, the most cost effective way to dispose of solid waste continues to be
____(a) incineration
____(b) recycling
*____(c) using sanitary landfills
____(d) dumping in the oceans

12. The best estimate of urban dwellers in the U.S. is
____(a) 5%
____(b) 10%
____(c) 75%
*____(d) 85%

13. The greatest source of air pollution is
*____(a) transportation
____(b) industry
____(c) solid waste disposal
____(d) residential areas

14. Which of the following is not biodegradable
____(a) bread
____(b) wood
*____(c) plastic
____(d) leaves

15. Pesticides that have been banned by the Federal Government have been banned because of
____(a) non-persistent toxicity
____(b) moderately persistent non-toxicity
____(c) expense in application
*____(d) permanent and harmful toxicity

16. Which of the following is the most harmful air pollutant?
____(a) carbon dioxide
____(b) sulfur dioxide
* ____(c) carbon monoxide
____(d) ammonia

17. Many organic wastes in water are decomposed. In the process, what material is removed from water?
____(a) carbon dioxide
*____(b) oxygen
____(c) hydrogen
____(d) sulfur

18. The chief industrial source of thermal pollution is the
*____(a) utilities industry
____(b) rubber and plastic industry
____(c) textile industry
____(d) paper industry

19. The depletion of the ozone level in the atmosphere has contributed to
____(a) global cooling and the 'Greenhouse effect'
*____(b) global warming and the 'Greenhouse effect'
____(c) scientific research
____(d) the probability of a new glacial age

20. Sonic booms are caused by aircraft that fly

____(a) low
*____(b) fast
____(c) slowly
____(d) near the speed of light

Part II:
Environmental Attitude

1. There are too many people living on the Earth today.
   (a) agree
   (b) disagree
   (c) no opinion
2. Family size should be limited in order to preserve a reasonable standard of living for all people.
   (a) agree
   (b) disagree
   (c) no opinion
3. Maintaining, improving, and in some cases restoring soil productivity is important to the welfare of all people.
   (a) agree
   (b) disagree
   (c) no opinion
4. Governmental subsidies to landowners for conservation is not a role that any governmental body should endorse.
   (a) agree
   (b) disagree
   (c) no opinion
5. Soil erosion is a minor problem in Texas and the U.S.
   (a) agree
   (b) disagree
   (c) no opinion
6. Since we have plenty of water we do not need to conserve water in Texas and the U.S.
   (a) agree
   (b) disagree
   (c) no opinion
7. Industrial manufacturers are rarely guilty of polluting the environment.
   (a) agree
   (b) disagree
   (c) no opinion
8. Safe waste disposal is important if we are to preserve the environment.
   (a) agree
   (b) disagree
   (c) no opinion
9. Increasing human population, the destruction of the rain forest, the increased use of raw materials, demands for a higher standards of living, the use of pesticides and chemically based fertilizers are all influencing and contaminating the environment.
   (a) agree
   (b) disagree
   (c) no opinion

10. Every citizen and every community needs to be concerned

with the protection of the environment.

(a) agree
(b) disagree
(c) no opinion

11. Man has generally treated the environment and the Earth in a proper manner.

(a) agree
(b) disagree
(c) no opinion

12. The United States does not have a population problem.

(a) agree
(b) disagree
(c) no opinion

13. Many people are over-reacting to environmental problems.

(a) agree
(b) disagree
(c) no opinion

14. Industrial progress is limited by conservation.

(a) agree
(b) disagree
(c) no opinion

15. The Permian Basin and our country have no serious environmental quality problems.

(a) agree
(b) disagree
(c) no opinion

16. A person should be able to use their land as they see fit.

(a) agree
(b) disagree
(c) no opinion

17. We need not be overly concerned about the environment since science and technology will find solutions to current and future problems.

(a) agree
(b) disagree
(c) no opinion

18. The Environmental Protection Agency should be given the power to ban the use of toxins that harm the environment in any way.

(a) agree
(b) disagree
(c) no opinion

19. In order to help control air pollution and to conserve energy, the Federal and State governments need to regulate the emissions of automobiles.

(a) agree
(b) disagree
(c) no opinion

20. In order to conserve electricity, air conditioners should be set no lower than 78 degrees.

(a) agree
(b) disagree
(c) no opinion

APPENDIX B:

'CURRICULUM SURVEY'

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

_____

Name of Person Responding:

_____

Position of Person Responding:

_____

Address of Person Responding:

_____

_____

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes No (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes No (Circle one)

If yes, please give a brief description of the planned curriculum:

APPENDIX C

COVER LETTERS

Cover Letter: Principal

01-30-91

Dear Principal,

We are asking for your assistance. Please consider the request for dissertation research assistance addressed in this letter.

The University of North Texas Institutional Review Board for the Protection of Human Subjects in Research (IRB) requires that all research projects that require the input of high school students be approved by the principal of the high school participating.

We are conducting a study on the knowledge and attitudes of 10th and 12th grade students in the Permian Basin Area of Texas using a survey instrument developed in 1973 and modified for this dissertation project. If you agree that students in your senior high school can participate, students will be given a survey of 40 questions that pertain to both their knowledge and attitudes towards the environment. Secondly, you or your designee will be asked to complete a brief data collection component included in this letter. The time spent on the knowledge and attitude survey will be minimal less than a class period. The included data completion component should take about 10 minutes to complete. A copy of each instrument is included in this letter.

We have selected a representative sample of schools in the Permian Basin Area of Texas for this study. Your high school was selected because it is in the Permian Basin Area.

Student information will remain confidential in this study. Students will be selected randomly or in a representative sample. Students will not sign their names on any forms and will be asked not to indicate who they are in any way. Data will be collected on student gender, student grade level, and on school populations in general and the tenth and twelfth grades specifically.

Students will be given an explanatory letter when they take the survey in this study and parental consent forms will be acquired prior to any survey of students in any school.

We ask that a minimum of 20 tenth graders and 20 twelfth graders be sampled in each school or that a maximum of 30 at each grade level be surveyed, if numbers permit. We would like a random sample from the student population. If this is not possible, then we would appreciate receiving information from a representative sample. 60 knowledge and attitude surveys will be sent with instructions and instructions for students to each school participating in this study. Additionally, one curriculum questionnaire will be sent to every superintendent in the Permian Basin Area regarding environmental education curricula.

Students are at no personal risk in this study and no information about individual students will be obtained. Copies of both the student survey and a brief data collection component are included in this letter. Please review the Environmental Knowledge and Attitude Survey and keep the file copy that I have included for your high school file.

Benefits of this research are twofold. We will obtain current data on student knowledge and attitudes towards the environment in the Permian Basin. Secondly, we will collect

Cover Letter: Superintendent

01-28-91

RE: Environmental Research
A District Curriculum Inquiry in the Permian Basin Area of Texas

To the Superintendent of Schools,

We are conducting a survey of school districts in the Permian Basin Area of Texas regarding the parameters of environmental education in our region. We would appreciate a response to the following questionnaire and have included a self-addressed stamped envelop for your convenience or the convenience of your designee.

The information that you provide will be used as a part of a larger study involving selected high school students in the Permian Basin Area of Texas in which the environmental knowledge and environmental attitudes of students are assessed.

This inquiry and information generated by the inquiry will be used to gain an overview of curriculum as an impetus in the formation of 10th and 12th grade levels of environmental knowledge and attitudes in the Permian Basin Area.

Thank you for your assistance. If you have any question please contact me at the address indicated.

Sincerely,

Sam Manning

Mr. Sam Manning
4412 Erie
Midland, Tx 79703
915-694-0371 (H)
915-689-1631

APPENDIX D

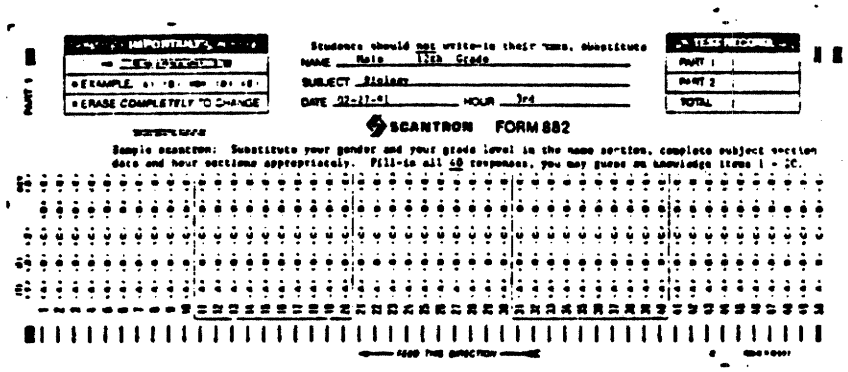
TEST INSTRUCTIONS & DATA COLLECTION COMPONENT

Environmental Testing Instructions:

Test time: c. 20 min.

1. All students should fill out the required information on the front of the testing packet: name of High School, circle grade level, circle gender, & circle classification. See paradigm provided below.

Paradigm A:



2. All students should be given a pencil. (Teachers may take-up pencils or give them to students.)

3. Scantron cards are to be filled out by students. In the name section, ask students to write-in their grade level and gender, they may fill-in the rest of the sections as the paradigm below indicates. Students should not write their name on the scantron card and are not required to do so. See paradigm below.

Paradigm B:

Name of your High School:
Los Hijos School (Please print)

Your gender (sex): Male (Female) (Circle one)

Your grade level: (10th) 12th (Circle one)

Your school classification: A AA (AAA) AAAA 5 AAAA
(Circle one)

4. Take up all tests and place them in the folders marked 10th grade females, males or 12th grade females and males. Place scantron cards in the appropriate folders.

5. All materials may be returned in the self-addressed mailing container provided unless other methods for return have been set-up or established.

6. Results will be sent to the Principal of all schools participating in the study.

7. If their are any questions, please contact Sam Manning at 915-694-0371 (h) or 915-689-1631 (w).

Thank you.

Sam Manning/4412 Erie/Midland, Texas 79703 - UNT/Research

Data Collection Component:

NAME OF HIGH SCHOOL: _____

NAME OF SCHOOL DISTRICT: _____

NAME OF PERSON RESPONDING: _____

1. Classification of High School:

A AA AAA AAAA 5 AAAA

(Please circle one of the above)

2. Total student population all grades: # _____

3. Total student population tenth grade only: # _____

4. Total student population twelfth grade only: # _____

Thank you for your assistance.

Sam Manning
4412 Erie
Midland, Tx 79703

915-694-0371 (H)
915-689-1631 (W)

For delay of authorization or non-participation:

If you have read the above and do not wish to participate in this research effort. Please sign, date and return this inquiry to Mr. Manning at the address above using the enclosed self-addressed envelop.

Principal's signature: _____
Date: _____
High school: _____

Please check one:

1. ____ I do not want to authorize participation in this study.

2. ____ I cannot authorize participation. Please forward materials to the Superintendent of schools.

3. ____ I must check with the Superintendent of schools to authorize the participation of my high school.

APPENDIX E

RETURN SURVEYS

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Ft Stockton ISD

Name of Person Responding:

Chris DuBois

Position of Person Responding:

Science Instructor : Phy. Sci. (Geology Chemistry) FSHS

Address of Person Responding:

1200 W 17th Street

Ft Stockton TX 79735

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes ? No (Circle one)

If yes, please give a brief description of the planned curriculum:

We have provisions for teaching

not made it a course offering to this date.

We offer a Geology class to our high school students, and I'm sure that our curriculum personnel consider that a step toward environmental education along with our Earth Science classes - but neither of these courses have or work with a developed, comprehensive Environmental Curriculum. (Non-coordinated.)

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Our Life Science, Earth Science, Biology and Physical Science Teachers do incorporate environmental impact units and/or ecology units in their coursework.

Additionally, in our Chemistry curriculum we address the environmental aspects of many situations from our own handling of wastes, etc. to large scale impact from industry & consumer source

Thank you for your assistance.

Please return this inquiry to

Sam Manning
UNT Dissertation Research
4412 Erie
Midland, Tx 79703

(915) 694-0371 (H)
(915) 689-1631 (W)

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Big Spring ISD

Name of Person Responding:

Murray Murray

Position of Person Responding:

Asst Superintendent

Address of Person Responding:

P.O. Box 590

Big Spring, Tx. 79721

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Under Study Yes No (Circle one)

If yes, please give a brief description of the planned curriculum:

Proposal Enclosed

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

Yes (No) (Circle one)

If yes, please describe briefly:

OUTDOOR CLASSROOM PROPOSAL

This document outlines some ideas on an outdoor classroom is proposed for Birdwell Park.

Our society is becoming increasingly technologically sophisticated and a scientifically and environmentally literate population is critical to the our future success. Since the key to our future success lies in our youth, we must do all that we can to promote science education. One way to do this is with fun, nonthreatening learning activities. An outdoor classroom can provide some of these learning activities. An outdoor classroom can provide the opportunity for the students of Big Spring to learn about natural resources and science from a natural setting. I feel this learning environment is highly conducive to learning and will make science alive and exciting for the students of Big Spring. A few points in support of locating an outdoor classroom at Birdwell Park are listed below.

1. It is very close to the high school and to the proposed site of the new junior high school. Its use will require no special permit, no time and money-consuming transportation, and no shifting of class schedules.

2. The park is not intensively used and preliminary discussions with city administrators are supportive of this use.

3. The site has easy access and can become a highly visible symbol of BSISDs commitment to quality education.

I feel this project will enjoy widespread support from several areas.

a. The USDA has a long history of supporting similar projects with technical help including topographic and soil maps, preparation of a written plan including suggestions to improve site, assistance in laying out work plans and arriving at cost estimates, suggestions for additional assistance from other resource agencies.

b. Local conservation groupes such as the Permian Basin Soil and Water Conservation Society will assist.

c. Several foundations will donate money to fund this proposal.

I propose that the entire project be funded from private dnations. The BSISD must support the use of this facility and hopefully assist in the upkeep. Ideas for studies and facilities include the following:

a. Greenhouse and outdoor garden to learn about agriculture and horticulture.

b. Pond and marsh to learn about aquatic systems and pollution.

c. Indoor laboratory and classroom with microscopes etc.

d. Natural vegetation areas and nature trail.

e. Soil Profile exhibit to laern about soils

f. Sundial

g. Weather and air pollution station

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Crane ISD

Name of Person Responding:

Mindy Phillips

Position of Person Responding:

Curriculum Director

Address of Person Responding:

511 W 8th St

Crane, TX [illegible]

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes **(No)** (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes **(No)** (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

9th Science – several week unit [illegible]

Elem – numerous science, math, social studies units, both textbooks + teacher made

HS Science classes like ecology in all relevant areas [illegible] textbooks + teacher made materials used

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Grady ISD

Name of Person Responding:

Gerald Singleton

Position of Person Responding:

Superintendent

Address of Person Responding:

HCR 72, Box 4, Lenorah, Texas 79749

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

(Yes) No (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

We offer courses in Plant and Wildlife Management and in Wildlife and Recreational Management at the high school level.

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

(Yes) No (Circle one)

If yes, please give a brief description of the plans for curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

We offer a course at the eighth grade level on Life Management Skills.

Thank you for your assistance.

Please return this inquiry to

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Midland ISD (Lee/Midland)

Name of Person Responding:

SEE

Position of Person Responding:

Teacher

Address of Person Responding:

3500 Neely

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

(Yes) No (Circle one)

If yes, please briefly describe the curriculum that you have implemented: Environmental Science, Environmental Awareness, Systems.

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes No (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

Yes No (Circle one)

If yes, please describe briefly:

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Ector County ISD

Name of Person Responding:

Gaylon Tiner

Position of Person Responding:

Science Consultant

Address of Person Responding:

PO Box 3912

Odessa Tx 79760

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education course already or a plan to implement such a curriculum in your school district, is there a course offering if any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

K-6 Science classes
7th Life Science units
8th Earth Science classes
10th - Biology. where applicable.

Thank you for your assistance.

Please return this inquiry to

Curriculum Inquiry: School District:

(Please type or print)

Name of School District:

Fasken ISD

Name of Person Responding:

J F Pagan

Position of Person Responding:

Supt

Address of Person Responding:

Fasken Isd 79733

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

Yes (No) (Circle one)

If yes, please describe briefly:

Enviromental education is touched on in a number of classes from social studies to industrial technology and home economics

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Pecos-Barstow-Toyah ISD

Name of Person Responding:

A L Ramsey

Position of Person Responding:

Supt

Address of Person Responding:

PO Box 569

Pecos Texas 79772

Survey: Environmental Education Curriculum
in the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Science courses

Thank you for your assistance.

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Rankin ISD

Name of Person Responding:

Bobby Dodds

Position of Person Responding:

Superintendent

Address of Person Responding:

P.O. Box 90

Rankin, Texas 79778

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Some environmental education is incorporated in the science courses offered in the Jr. High and High School

Thank you for your assistance.

Please return this inquiry to

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Marfa ISD

Name of Person Responding:

CARL P ROBINSON

Position of Person Responding:

Supt

Address of Person Responding:

PO Box T

MARFA, TX 79843

Survey: Environmental Education Curriculum in the Permian Basin Area of Texas

1. Has your school district formally implemented Environmental Education Classes as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that was implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education course, program or a plan to implement such a curriculum in your school district, is there a course offering if any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Earth + Life Science
Physical Science
Health

Thank you for your assistance.

Please return this inquiry to:

Ben Manning
UNT Dissertation Research
4412 Erie
Midland, Tx 79703

(915) 694-0371 (H)
(915) 689-1631 (W)

[redacted]

Curriculum Inquiry: School District

(Please type or print)

Name of School District: ~~Sterling ISD~~ Terrell County ISD

Name of Person Responding: [illegible]

Position of Person Responding: ~~Superintendent~~

Address of Person Responding: [illegible]

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the plans: curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

All Biology Courses

Thank you for your assistance.

Please return this inquiry to

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Greenwood ISD

Name of Person Responding:

Don Davis

Position of Person Responding:

Principal

Address of Person Responding:

2700 FM 1379

Midland Tx 79701

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

Yes No (Circle one)

If yes, please describe briefly:

EEC offerings are presented as units in Several Science Courses 6-12

Thank you for your assistance.

Please return this inquiry to

San Mannion

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Stanton

Name of Person Responding:

J McGregor

Position of Person Responding:

H.S. Prin.

Address of Person Responding:

Box 730

Stanton, Tx 79782

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

The sciences, particularly earth science, cover subjects relating to and including environmental issues.

Thank you for your assistance.

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Monahans-Wickett-Pyote ISD

Name of Person Responding:

Richard Bain, Ed D

Position of Person Responding:

Assistant Supt

Address of Person Responding:

MWPISD

606 S Betty Monahans Tx 79756

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Units in Science classes.

Thank you for your assistance.

Please return this inquiry to

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Glasscock County ISD

Name of Person Responding:

[illegible]

Position of Person Responding:

[illegible]

Address of Person Responding:

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Elem Science Classes (K-6)
Middle School (7 & 8)

Thank you for your assistance.

Please return this inquiry to

Sam Manning

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Culberson County ISD

Name of Person Responding:

MARIO SOTELO

Position of Person Responding:

SUPERINTENDENT

Address of Person Responding:

P.O. Box 899

VAN HORN TEXAS 79855

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

(Yes) No (Circle one)

If yes, please give a brief description of the planned curriculum:

We are currently teaching a 7th-8th grade course in Southwest Environmental Studies. The course has been taught for one year and is scheduled to be approved by the School Board this year.

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

Yes (No) (Circle one)

If yes, please describe briefly:

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Grand Falls-Royalty ISD

Name of Person Responding:

Jim Yancey

Position of Person Responding:

Principal

Address of Person Responding:

Box 10

Grandfalls, Tx 79742

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

(Yes) No (Circle one)

If yes, please describe briefly:

Thank you for your assistance.

Please return this inquiry to

NO

Curriculum Inquiry: School District

(Please type or print)

Name of School District:

Buena Vista ISD

Name of Person Responding:

Carl Foster

Position of Person Responding:

Superintendent

Address of Person Responding:

Box 310

Imperial, Texas 79743

Survey: Environmental Education Curriculum
In the Permian Basin Area of Texas

1. Has your school district formally implemented an Environmental Education Class/Course as a part of the Curriculum?

Yes (No) (Circle one)

If yes, please briefly describe the curriculum that you have implemented:

2. If your school district does not currently have a formal Environmental Curriculum, are there plans for such a curriculum in the future?

Yes (No) (Circle one)

If yes, please give a brief description of the planned curriculum:

3. In lieu of an Environmental Education Course offering or a plan to implement such a curriculum in your school district, is there a course offering of any kind that incorporates a unit, lesson, module, or set of activities centered around educating students regarding the environment?

Yes (No) (Circle one)

If yes, please describe briefly:

Thank you for your assistance.

Please return this inquiry to

APPENDIX F

HISTOGRAMS

Histogram A: Small High Schools Environmental Knowledge

N = 113

Statpal - Histogram - 11/22/92 17:29 - File: S3

For variable: EKL

	Lower bound	Upper bound		Frequency N	Frequency prop.	
[	3.0000	4.1667	)	8	0.071	********
[	4.1667	5.3333	)	12	0.106	************
[	5.3333	6.5000	)	8	0.071	********
[	6.5000	7.6667	)	14	0.124	**************
[	7.6667	8.8333	)	14	0.124	**************
[	8.8333	10.0000	)	13	0.115	*************
[	10.0000	11.1667	)	24	0.212	************************
[	11.1667	12.3333	)	7	0.062	*******
[	12.3333	13.5000	)	6	0.053	******
[	13.5000	14.6667	)	4	0.035	****
[	14.6667	15.8333	)	2	0.018	**
[	15.8333	17.0000	]	1	0.009	*

alid cases: 113 Missing cases: 0

Histogram B: Small High Schools Environmental Attitude

$\underline{N}$ = 113

```
                  Statpal - Histogram   -   11/22/92  17:29 - File: S3
For variable:  EAL
    Lower         Upper            Frequency
    bound         bound          N        prop.

[    2.0000       3.4167 )       7       0.062   *******
[    3.4167       4.8333 )       6       0.053   ******
[    4.8333       6.2500 )      34       0.301   **********************************
     6.2500       7.6667 )      17       0.150   *****************
     7.6667       9.0833 )      28       0.248   ****************************
[    9.0833      10.5000 )      12       0.106   ************
[   10.5000      11.9167 )       3       0.027   ***
[   11.9167      13.3333 )       3       0.027   ***
[   13.3333      14.7500 )       1       0.009   *
[   14.7500      16.1667 )       0       0.000
[   16.1667      17.5833 )       1       0.009   *
[   17.5833      19.0000 ]       1       0.009   *

Valid cases: 113    Missing cases: 0
```

Histogram C: Mid-sized High Schools Environmental Knowledge

N = 189

```
               Statpal - Histogram   -   11/22/92  17:30 - File: M3
For variable: EKL       environmental knowledge
    Lower        Upper        Frequency
    bound        bound       N      prop.

[   1.0000      2.2500 )     5     0.026  *****
[   2.2500      3.5000 )     2     0.011  **
[   3.5000      4.7500 )     5     0.026  *****
[   4.7500      6.0000 )    17     0.090  *****************
[   6.0000      7.2500 )    37     0.196  *******************************
[   7.2500      8.5000 )    26     0.138  **************************
[   8.5000      9.7500 )    34     0.180  *******************************
[   9.7500     11.0000 )    17     0.090  *****************
[  11.0000     12.2500 )    32     0.169  *******************************
[  12.2500     13.5000 )     7     0.037  *******
[  13.5000     14.7500 )     4     0.021  ****
[  14.7500     16.0000 ]     3     0.016  ***

Valid cases: 189   Missing cases: 0
```

Histogram D: Mid-sized High Schools Environmental Attitudes

$\underline{N}$ = 189

```
                  Statpal - Histogram   -   11/22/92  17:31 - File: M3
For variable: EAL            environmental attitude
    Lower         Upper          Frequency
    bound         bound         N       prop.

[    0.0000      1.6667 )      2      0.011  *
[    1.6667      3.3333 )      6      0.032  **
[    3.3333      5.0000 )      7      0.037  ***
[    5.0000      6.6667 )     46      0.243  ****************
[    6.6667      8.3333 )     79      0.418  ***************************
[    8.3333     10.0000 )     26      0.138  *********
[   10.0000     11.6667 )     16      0.085  ******
    11.6667     13.3333 )      3      0.016  *
    13.3333     15.0000 )      1      0.005  *
[   15.0000     16.6667 )      1      0.005  *
[   16.6667     18.3333 )      0      0.000
[   18.3333     20.0000 ]      2      0.011  *

Valid cases: 189   Missing cases: 0
Each * represents 3 cases.
```

Histogram E: Large High School Environmental Knowledge

$\underline{N} = 180$

```
                Statpal - Histogram   -   11/22/92  17:32 - File: B2
For variable:   EKL          environmental knowledge level
   Lower          Upper          Frequency
   bound          bound          N      prop.

[    3.0000      4.0833 )        7      0.039  *******
[    4.0833      5.1667 )       12      0.067  ************
[    5.1667      6.2500 )       18      0.100  ******************
[    6.2500      7.3333 )       20      0.111  ********************
[    7.3333      8.4167 )       31      0.172  *******************************
[    8.4167      9.5000 )       18      0.100  ******************
     9.5000     10.5833 )       25      0.139  *************************
    10.5833     11.6667 )       21      0.117  *********************
[   11.6667     12.7500 )       20      0.111  ********************
[   12.7500     13.8333 )        5      0.028  *****
[   13.8333     14.9167 )        1      0.006  *
[   14.9167     16.0000 ]        2      0.011  **

Valid cases: 180    Missing cases: 0
```

Histogram F: Large High School Environmental Attitude

N = 180

```
              Statpal - Histogram   -    11/22/92  17:32 - File: 82
For variable: EAL        environmental attitude level
   Lower          Upper        Frequency
   bound          bound        N        prop.

[    0.0000      1.5000 )      1       0.006   *
[    1.5000      3.0000 )      2       0.011   *
[    3.0000      4.5000 )     17       0.094   *********
[    4.5000      6.0000 )     20       0.111   **********
[    6.0000      7.5000 )     62       0.344   *******************************
[    7.5000      9.0000 )     28       0.156   **************
[    9.0000     10.5000 )     38       0.211   *******************
[   10.5000     12.0000 )      8       0.044   ****
    12.0000     13.5000 )      3       0.017   **
    13.5000     15.0000 )      0       0.000
[   15.0000     16.5000 )      0       0.000
[   16.5000     18.0000 ]      1       0.006   *

Valid cases: 180   Missing cases: 0
Each * represents 2 cases.
```

Histogram: Combined High Schools (11)

Student Sample: $\underline{N}$ = 482

Environmental Knowledge

Statpal - Histogram - 9/14/99 14:03 - File: FM10

'or variable: EKL es

Lower bound	Upper bound		Frequency N	prop.	
1.0000	2.3333	)	5	0.010	**
2.3333	3.6667	)	7	0.015	**
3.6667	5.0000	)	15	0.031	****
5.0000	6.3333	)	84	0.174	*********************
6.3333	7.6667	)	54	0.112	**************
7.6667	9.0000	)	71	0.147	******************
9.0000	10.3333	)	119	0.247	******************************
10.3333	11.6667	)	50	0.104	*************
. 6667	13.0000	)	42	0.087	***********
..0000	14.3333	)	27	0.056	*******
14.3333	15.6667	)	5	0.010	**
15.6667	17.0000	]	3	0.006	*

'alid cases: 482 Missing cases: 0

Each * represents 4 cases.

Histogram: Combined High Schools (11)

Student Sample: $\underline{N}$ = 482

Environmental Attitude

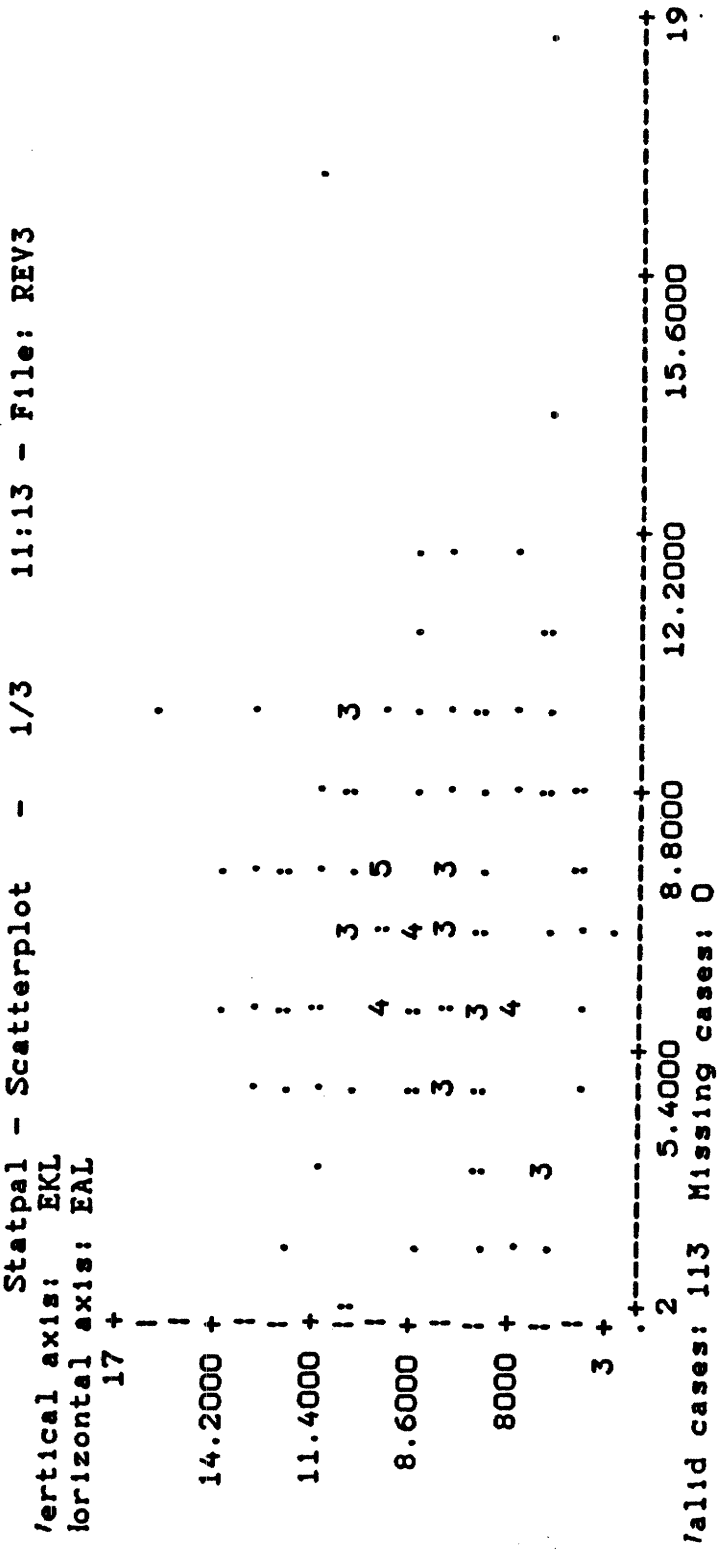
```
            Statpal - Histogram   -   9/14/99  14:01 - File: FM10
For variable: EAL
   Lower         Upper        Frequency
   bound         bound       N      prop.

[   0.0000     1.6667 )    3     0.006  *
[   1.6667     3.3333 )   19     0.039  ****
[   3.3333     5.0000 )   26     0.054  ******
[   5.0000     6.6667 )  135     0.280  ***************************
[   6.6667     8.3333 )  168     0.349  *********************************
[   8.3333    10.0000 )   54     0.112  ***********
[  10.0000    11.6667 )   60     0.124  ************
[  11.6667    13.3333 )    9     0.019  **
[  13.3333    15.0000 )    2     0.004  *
[  15.0000    16.6667 )    1     0.002  *
[  16.6667    18.3333 )    2     0.004  *
[    .3333    20.0000 ]    3     0.006  *

/alid cases: 482   Missing cases: 0
Each * represents 5 cases.
```

APPENDIX G

SCATTERPLOTS

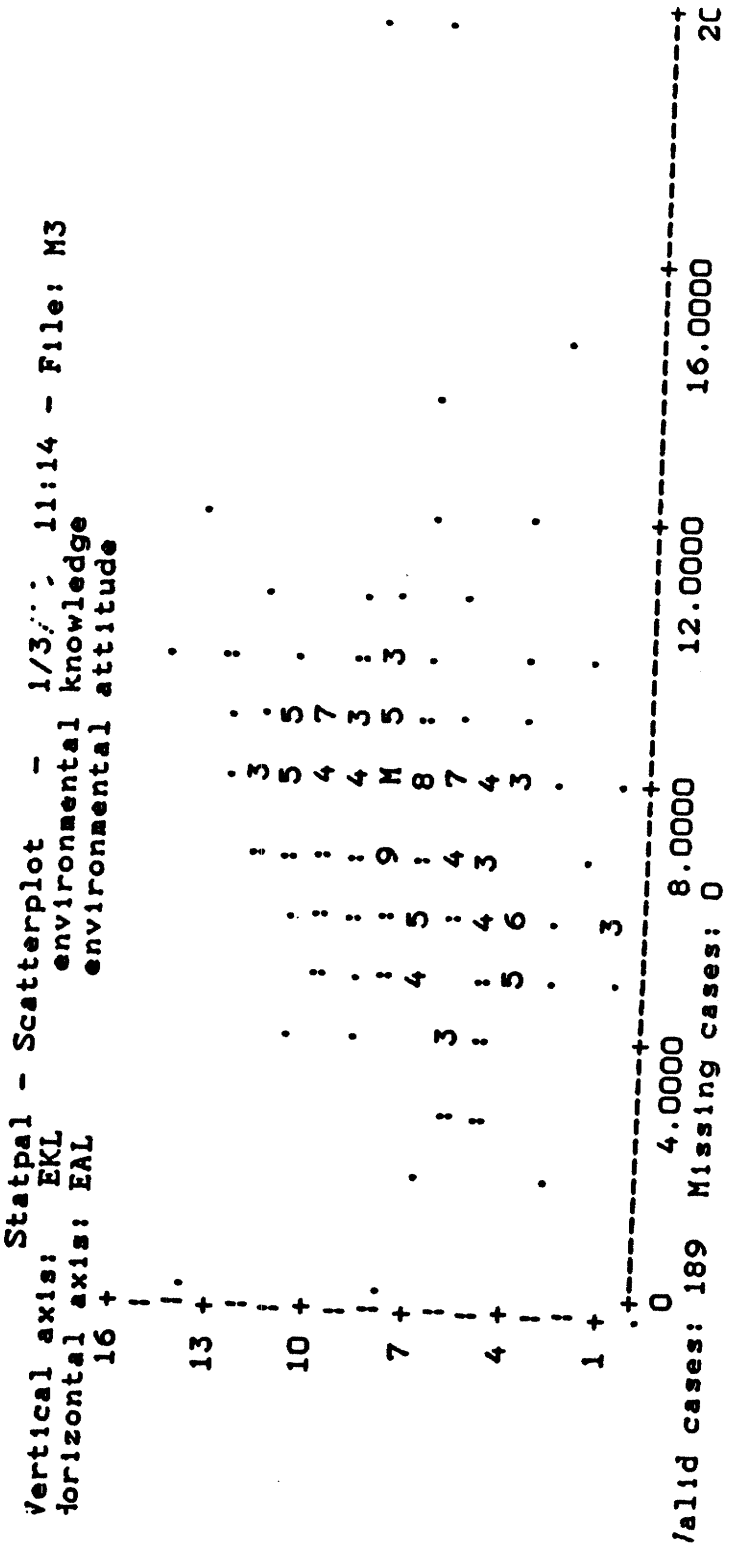
Scatterplot A: Environmental Knowledge and Attitude - Small High Schools

N = 04 Student Sample: N = 113



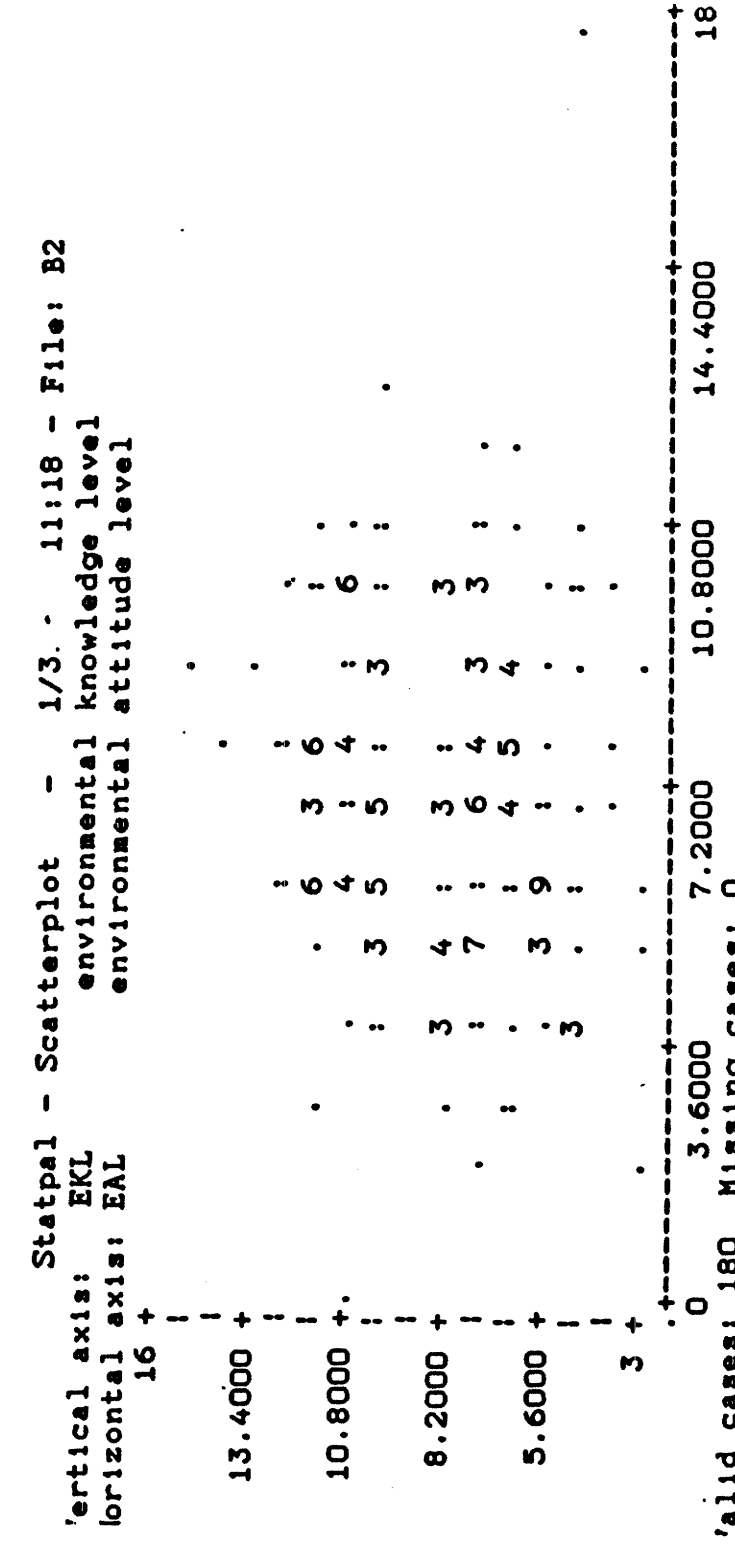
Scatterplot B: Environmental Knowledge and Attitude Level - Mid-sized High Schools

N = 04 Student Sample: N = 189



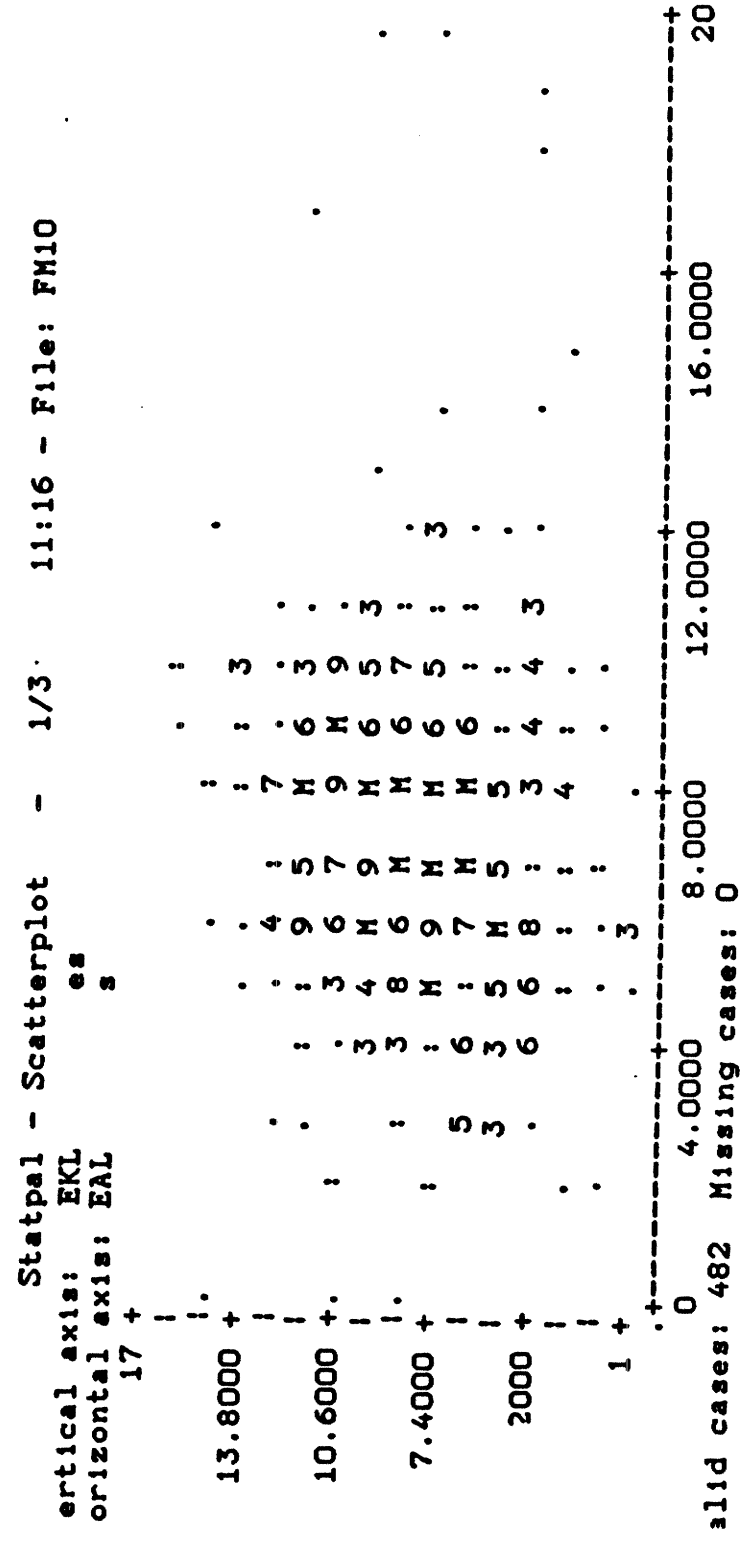
Scatterplot C: Environmental Knowledge and Attitude Level - Large High Schools

N = 03 Student Sample: N = 180



Scatterplot D: Environmental Knowledge and Attitude Level - All High Schools

N = 11 Student Sample: N = 482



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