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Children's Awareness of Environmental Pollution

Carol A. Darling
Utah State University

CHILDREN'S AWARENESS OF ENVIRONMENTAL POLLUTION

by

Carol A. Darling

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Approved:

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Major Professor

_____
Committee Member

_____
Committee Member

_____
Dean of Graduate Studies

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Carol A. Darling

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ABSTRACT

Children's Awareness of Environmental Pollution

by

Carol A. Darling, Master of Science

Major Professor: Dr. Jay D. Schvaneveldt
Department: Family and Child Development

The purpose of this study was to determine children's awareness of environmental pollution and the effect of environmental education on the awareness of preschool children.

Data for this study were collected by individually interviewing 20 preschool, 20 first grade and 20 third grade children. These 60 children were presented 15 colored slides and 9 words denoting various types of pollution and environmental symbols and slogans. The slides varied from litter on a beach, chimneys emitting black smoke, and polluted water to such environmental symbols as Smokey Bear, Johnny Horizon, and Woodsy Owl. In addition, the environmental symbols were also presented verbally, accompanied by such words as litter, pollution, and ecology. The children's responses were evaluated and used to indicate the effect of age and sex upon children's awareness, the relationship between children's responses to pictorial and verbal stimuli, and the effects of an environmental education program on the awareness of preschool children.

The findings of this study indicate that there are differences in awareness of environmental pollution between different ages of children, but not

between males and females. As children become older, there is both an increasing awareness of environmental pollution and an increasing correlation between the recognition of visual and verbal stimuli. An environmental education unit was also found to influence the environmental awareness of preschool children. While the experimental group, which was involved in an environmental education unit showed significant increases in environmental awareness, the control group did not.

(89 pages)

INTRODUCTION

Origin of the Problem

The threat of environmental pollution has become one of the chief concerns of this decade and perhaps the rest of this century. For most Americans the decay of their environment has become a personal experience by drinking impure water, hearing the sonic boom of a jet, or by reading an environmental obituary in the daily newspapers. Although many individuals think the industrialists are the villains who pollute the environment, the major villains are the consumers who desire and demand new, more, faster, and bigger playthings without thinking about the cost to the environment. Many of today's environmental reformers believe that the hope for the future doesn't lie in technology or legislation, but in abstinence (Newsweek, 1970). Unfortunately, the behavioral changes in habit that are required to save the environment are so devastating to the population's notions of personal freedom, that the public may prefer to surrender to inertia than to change (Star, 1971).

Since changing adult behavior is so difficult, one possibility might be to instill an environmental awareness in young children, so that they will grow up learning a behavioral pattern that contains the necessary abstinence and concern needed for the prolonged future of a healthy environment. According to Robert H. Finch, former secretary of Health, Education, and Welfare:

> Environmental study should be provided for children, so that they can grow up with the concept of environment as being everything that makes up their world and with an understanding of the interdependency of all its numberless elements. (National Education Association, 1971, p. 1)

Since it appears to be desirable for children to develop a behavioral pattern of environmental concern, the question then becomes, how aware are children of the pollution of their environment. Although there has been a recent bombardment of antipollution information, has the message reached the children?

It has come to the investigator's attention that some children are aware of pollution. A short time ago while living in the Washington, D.C., area, a five year old boy who was visiting from another city constantly referred to the Potomac River as being polluted. Although no adult mentioned pollution in his presence, the "polluted Potomac" became his favorite topic of conversation. Other reports from parents have also confirmed that some young children are aware of environmental pollution, but the extent of their awareness and the age level at which it begins have not been investigated.

Problem

Although there has been a considerable amount of research and concern over the quality of environment that will be available for the children of today, there has been little research to determine if these children are even aware of this problem. Pollution is not only a current issue, but it is so vital that it is mandatory that tomorrow's citizens have the awareness necessary to enable them to make the crucial decisions affecting their future. Since the future of any nation depends largely upon the ideas children acquire when they are young, it is

necessary to know the best time, place, and age to employ an environmental awareness program in order to obtain the maximum potential effect. The problem of trying to increase environmental concern and awareness might be the most important task facing the human species.

Purpose

The purpose of this study was to investigate children's awareness and values regarding environmental pollution, as related to age and sex. It was also the objective of this study to investigate the relationship between children's responses to visual and verbal stimuli, and to determine the effectiveness of an environmental education program on the awareness and values of preschool children.

Hypotheses

1. There is a significant difference in the awareness of environmental pollution between older and younger children.

2. There is no significant difference between males and females in their awareness of environmental pollution.

3. An environmental education program significantly increases young children's awareness of pollution.

4. Children who are highly responsive to visual pollution stimuli are also highly responsive to verbal pollution stimuli.

REVIEW OF LITERATURE

The purpose of this review is to present research findings from the literature concerning children's awareness of environmental pollution. Although there exists an extensive amount of literature, there is a definite lack of information regarding children's environmental awareness, responses, values, or programs. Since the literature on pollution is extensive, this review has only focused on the general present status of the problem. Environmental education and specific programs for young children have been investigated, although the obtainability of these materials is difficult, since many of the programs developed by individual teachers have not been published. In addition a brief comment on perceptual development and value formation has been included to help clarify how the child experiences his environment.

Pollution Problem

The pollution problem has become a major issue within the last five years. As an indication, a frequency count of the environmental and pollution bills, mentioned in the last five editions of the Digest of Public General Bills and Resolutions, shows that there were two proposed bills in 1967, 19 in 1968, 20 in 1969, 12 in 1970, and 120 in 1971 (Congressional Research Service, 1967-1971). A few years ago nobody was paying attention to the environment until some startling things began to happen. Newsweek (1971) reported that Lake Erie had died; the Cuyahoga River in Ohio, which was overrun with volatile industrial

discharges, caught fire; and Thor Heyerdahl reported seeing considerable amounts of oil, dead fish, and plastic bottles in the mid-Atlantic. Another article (Scientists' Institute for Public Information, 1970) mentioned that recently there has been an increasing number of deaths in periods of dense smog, while another report (Today's Child, 1971) claims that infants and children in large cities are exposed to such high levels of lead in the air, that this condition qualifies as a health hazard. Commoner (1970) has also commented that the young people of today are the first generation to carry strontium 90 in their bones, DDT in their fat, and asbestos in their lungs. In addition to these common forms of pollution, other environmental hazards exist such as pesticides, contaminated food (Time, 1971), and ionizing radiation which is a long term problem being greatly amplified by the careless use of nuclear power plants and bomb tests (Cook, 1971).

Several causes of pollution have been investigated, but according to Commoner, Coor, and Stamler (1971), increasing population, increasing consumption, and the kind of technology used are the main factors upon which pollution depends. Pollution has also become a political issue, since candidates on all levels are competing to see who can allegedly do the most to save the environment (Newsweek, 1970). The Federal Government has instituted several corrective programs, but the estimated cost of cleaning polluted streams and lakes is between 26 and 29 billion dollars, while the cost of cleaning up the air could cost up to 15 billion dollars (Time, 1970). Although the cost is immense, this must be the decade when America pays its debt to the past be reclaiming

the purity of its air, waters, and living environment. It's literally now or never (Newsweek, 1970).

Environmental Education

According to Stapp (1969), environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated toward their solution. The idea of protecting the environment is not a new idea since it was previously called conservation. But, according to Covert (1969), the name conservation has lost its real significance and a new name with a larger base, such as environmental education, is necessary to accommodate the magnitude of the need. Lowe (1971) has also indicated that environmental education is not just conservation education, nature walks, or a new subject to be added to the curriculum, but a way of thinking that deals with the quality and reason for life. In contrast, Miller (1971) feels that there is no need to teach about pollution, since the individual is already concerned. However, the individual does need to know how widespread and far reaching the pollution of the environment is, and the totality of its threat. The individual also needs to learn what avenues he can take whenever a new threat appears in his environment, and how to develop solutions when none appear to exist.

A special boost to environmental education came when the Environmental Education Act was passed October 13, 1970. This act provided for grants to conduct special educational programs and activities concerning ecological-environmental education and to establish a National Advisory Commission on

technology and environment. The purpose of this act was to educate the American people on problems of environmental abuse and the long-term consequence of interference with the ecological cycle (U.S. House of Representatives, 1970). Unfortunately, congress only appropriated two million dollars to start the program instead of the five million dollars authorized for the first year (Callison, 1971).

Although most of the educational programs have been written and taught by individual teachers in local school districts, several extensive environmental education programs have been recently published. A report edited by Lockhard (1970), noted the Science Curriculum Improvement Study (SCIS) which focuses on the fundamental concepts of biological and physical sciences for effective participation in twentieth century life. In addition, the Conservation Curriculum Improvement Project (CCIP) has recently begun and is trying to provide interdisciplinary materials for the teaching of environmental education in a variety of contexts. The Environmental Studies Project (ESP) is also a new program concerned with students' awareness, interaction with, and manipulation of the environment (Environmental Studies Project, 1971). The National Environmental Education Development (NEED) (National Park Service, 1969) is an interdisciplinary program, which was developed for fourth and fifth graders, although additional materials are presently being created for younger children. A Survey of School Environmental Programs (Wagar, 1970) reports that more than half of all environmental education programs are currently using this National Park Service curriculum resource.

According to McDonald (1970) outdoor learning activities have become very popular in environmental education programs. While outdoors, children can develop their senses, get relief from structured classroom learning, and can investigate in a place where objects are real. Allen (1970) reports English teachers are trying to help teach ecology by using environmental words and sentences when teaching grammar. Examples such as "Lake Erie ain't safe to swim in," would increase sensitivity to English and also the plight of the polluted earth.

Although these programs exist, what are the students' responses to them? At present there are no research findings regarding the effects of the recently developed environmental education programs, but Swan (1970) did attempt to determine responses to pollution by studying the attitudes of high school students to air pollution. He found that some of the students were both aware and concerned with air pollution, while others who were very aware, cared little. He also found that race and socioeconomic class may have an effect upon awareness, although they are not critical factors. Even though some students still appear uninterested, Marland (1971) claims that unless the present environmental crusade is deeply rooted in the educational system and within the consciousness of the people, the current high public interest will fail.

Environmental Education for Young Children

According to Kluge (1971) one of the things the world needs is environmental education for young children. Just as a child is helped to understand his role in the classroom environment, he must also be encouraged to look beyond

his immediate surroundings to the forces and conditions affecting these surroundings. Some educators have responded by prescribing general objectives for preschool and elementary children, proposing that emphasis should only be given to increase the child's perceptual level through the appreciation of space, form, and nature (U.S. Department of Health, Education and Welfare, 1971). But, according to Roth (1971), during the preschool and primary years, children should be given wide exposure to a diversity of environmental experiences, since such exposure helps children to develop a mental "experience bank" on which they can continue to draw for synthesizing and abstracting as they grow. Children should be given opportunities to develop positive individual and group coping styles for dealing with environmental issues they perceive, that are potentially within their capacity to resolve. Caution must be taken though, of becoming too deeply involved in issues of such magnitude that children see no hope of resolution, or else such issues will breed on attitude of fear and despair.

Unfortunately, there are presently very few programs for young children. A national survey of environmental education programs in schools enrolling 90 percent of the nations public school children, reports that only 4.4 percent of the districts had any programs for the prekindergarten child (National Education Association, 1970). There are also very few established curriculum guides for young children's environmental education programs. Several educators have suggested conceptual frameworks for environmental ideas, but have offered no suggestions for possible learning experiences. One of the few existing environmental curriculum guides for young children, which also includes teaching activities, is the People and Their Environment Series developed by the

Conservation Curriculum Improvement Project (CCIP) (Brennan, 1968). A curriculum guide edited by Gundlach (1969), is another which contains both concepts and activities. In addition his investigations have indicated that children at the kindergarten level were actually able to comprehend several environmental ideas. Three hundred fifty educators were presented 112 environmental education concepts, and were asked to indicate which concepts could be comprehended at their level. It was found that 44 of the most important concepts could be introduced by grade six, and 28 of these concepts could even be presented between the kindergarten and third grade level.

Since so few published programs for young children exist, individual teachers have tried to create their own. Junek (1971) reported of her successful experience teaching five year olds in New York City to focus their attention on pollution in the city, and to develop concepts of pollution based on personal experience. Ayers (1969) in his attempt to teach science to preschool children, aged three to five, found significant achievement by all children when compared to a group not exposed to the program.

Other nonschool programs have been tried at Drumlin Farms (Massachusetts Audubon Society, 1971-1972), where an environmental program for four and five year old children has been designed to give children direct contact with the environment by exploring a field, conversing with tame animals, or catching a frog. Another program has been established at Bryce Canyon National Park, Utah (Salt Lake Tribune, 1970) where an Environmental Day School is conducted for young children to stimulate their environmental awareness and concern.

Although very little research has recently been conducted on the effects of these educational programs, Donnelly (1957) investigated the conservation ideas of 282 urban children and found that conservation ideas may be learned from a variety of sources, but direct experience and observation seem to be the best. Consequently, first hand active investigation helps to make for more complete and lasting conservation learning. Graff (1962) also studied the conservation understandings of elementary school children and found that 25 to 35 percent of these students held understandings in one area of conservation, while only 10 percent indicated understandings in four subject areas. His study only included fourth, fifth, and sixth grade students, and strongly recommended the need of research aimed at the primary level, to provide conservation educators and school curriculum specialists with research findings, upon which curriculum development programs could be based.

Perceptual Development

Perception is crucial to children's awareness of environmental pollution and to their ability to react to stimuli presented in testing procedures. Although the literature on perception is extensive, only a brief comment on perception will be given in order to help clarify how the child experiences his environment.

According to Dember (1960) perception involves the acquiring of knowledge by means of the senses, about particular facts in the physical world. Garrison (1952) indicates that recognition begins developing at three months and continues until a child can clearly distinguish visual forms at approximately two years of age, while other studies suggest perception begins earlier.

According to Frantz (1961), experiments have shown that children's ability to perceive the form of objects is actually innate, although maturation and learning play important roles in its development.

It is through perception that a child learns about his environment. The percept, or stimulus impression obtained through the senses, combines with mental images, verbal symbols, and related input, to form concepts (Sale and Lee, 1972). Kagan (1971) agrees, and states that perception is a quickly constructed process that has a primary point of reference. As the mind gathers information from the environment, as well as from memory, it automatically relates the new information back to that basic point of reference. Although children spontaneously interpret events around them, Kagan notes that the form of their interpretations changes with age. The infant usually translates experience into images, whereas an older child is likely to rely on symbols or concepts. Ausubel (1958) agrees that perception reflects interaction between the visual stimulus and past experiences, but he also notes the importance of internal determinants, such as needs and values, on an individual's perception. Therefore, a child can see a stimulus, but he may not be able to comprehend it, unless he has had some meaningful past experiences and has satisfied internal needs and values.

According to Stone and Church (1968), much has yet to be learned regarding children's perception of still pictures. It is known that picture recognition begins late in infancy and that toddlers can recognize pictures of objects, particular people, and emotions. Toddlers can even recognize pictures of familiar objects taken at unfamiliar angles, since it appears that young

children may at first be indifferent to the inversion of pictures. Unfortunately, the observer can never directly share the content of a child's perceptual experience, but must always resort to inference from his behavior and verbalizations (Ausubel, 1958).

Value Formation

Since internal determinants, such as needs and values, affect perceptual responses, the formation of values can be important to children's environmental perception, responsibility, or concern. According to Ausubel (1958), values refer to ways of striving, believing, and doing, whenever purpose and direction are involved, or choice and judgement are exercised.

Although children are born into a society where norms and values are established, it is uncertain how children acquire the fairly stable value systems of adult life. The most conspicuous factor in the development of a child's social values appears to be his home and family, where the democratic atmosphere, interparental relationships, and parental attitude toward peer activity have been shown to be specially significant in character development (Dukes, 1958). Ausubel (1958) agrees and reports that parental attitudes affect value development in children, by the recurrent indoctrination (training, percept examples, incidental exposure) reinforced by sanctions and experiences with socializing agents. But, he states that parents aren't always the sole motivating factor, since the essential motivation in value formation is the need to retain the acceptance and approval of persons that provide derived status. Therefore, value assimilation can be considered an unconditional act of personal loyalty,

in which the objective content of what is being internalized may be irrelevant. The values of other persons or groups are thereby internalized by habituation or imitation.

Age is also a factor in value formation, since Dukes (1958) reports that young children have a flexible scale of values which changes with age and the demands of current situations. Ausubel (1958) noted that suggestibility in children decreases with age, hence with increasing age, a child's values tend to become more typical of the culture at large and less typical of his own family. According to Gilbert (1971) age affects the intensity of a belief or value formation, since beliefs acquired through culture as a child are stronger than those acquired as an adult through authoritative opinion or personal reasoning.

In addition to valuing a clean environment, responsibility for maintaining a clean environment also needs development. According to Milton and Harris (1958) training for responsibility should not be put off until the child is considered old enough. Unfortunately, children often believe that the government is so benevolent, wise, and powerful that it will solve all problems. Children consequently have difficulty in realizing the effect of the individual in attaining any political or environmental goal (Hess, 1969). Milton (1958) reports that responsibility acceptance for maintaining a clean environment depends on understanding and habit formation, but to accomplish this task, the child must be given the information which is necessary for understanding the problem.

Summary of Review

It has been shown that pollution is definitely a vast and crucial problem, and consequently several educational institutions have recently become involved in environmental education. Unfortunately, since any relevant research is either outdated or deals with older children, there is a critical gap of information concerning young children and the environmental problem. Not only is there a lack of environmental programs and curricula for young children, but research has not shown the impact of environmental education on young children's values, concern, or awareness.

Gilbert (1971) has stated that a belief gained in childhood is the most permanent, but is this concept applicable to environmental concern? There is a definite need for a considerable amount of research on this topic due to the lack of information and the corrective potential involved in beginning an environmental education program early in life. To alleviate some of these concerns this study was completed to determine the awareness of different ages of young children to environmental pollution and the effects of environmental education on this awareness.

PROCEDURE

Sample

The subjects that were used to test the hypotheses consisted of 60 male and female children from Logan, Utah. Although the Logan, Utah, area is relatively unpolluted compared to large cities and industrial centers, the city has been concerned with pollution as evidenced by its recycling plant, educational programs, and Boy Scout projects. Utah State University has also been a major factor in contributing to Logan's pollution awareness through curriculum, speakers, and conferences. In addition, due to a recent grant from the Rockefeller Foundation, the University has become increasingly involved in environmental education and research.

The sample was composed of three age groups of children as defined by grade level in school. The youngest group consisted of 10 males and 10 females from the Utah State University Child Development Laboratory. The other two groups of children, which consisted of 10 males and 10 females each, attended a first and third grade class at Hillcrest Elementary School in Logan, Utah. The elementary school was selected by the local school board and the specific first and third grade classes were chosen by the principal, with the approval of the teachers involved. All students in each elementary class were tested in either the actual investigation or pilot study, although

only the responses of Caucasian students were used, since the verbal responses of the Mexican and Indian students were minimal.

The preschool sample was selected from the entire population of children attending the East and West Morning Child Development Laboratories at Utah State University. The children who were tested were those that would be attending the Child Development Laboratory for an additional quarter and were willing to interrupt their activity for the interview. Fourteen of the preschool children attended the East Morning Laboratory where the investigator subsequently taught an environmental education unit, while six preschool children attended the West Morning Laboratory, which did not participate in the environmental education program.

The distribution of sexes was kept equal among the three groups, while the differences in ages between the groups was varied. Table 1 shows the composition of the sample by age and sex. Age is shown by year and month in each category.

Table 1. Composition of total sample by age and sex

	Preschool	First grade	Third grade
Number of boys/grade	10	10	10
Average age of boys	3-11	6-10	9-1
Number of girls/grade	10	10	10
Average age of girls	4-1	6-12	9-0
Total number of children	20	20	20
Average age of children	4-0	6-11	9-1

The Instrument

The data for this research were collected by the use of an interview conducted with the help of visual and verbal stimuli. Fifteen colored slides of varying types and degrees of pollution and three nonpollution slides were presented to the subjects to elicit responses indicating their awareness and values regarding pollution. In addition, verbal stimuli composed of nine words and phrases, commonly used in communicating the pollution problem, were presented to the subjects to determine if a child was aware of the words and their meanings. The content of both types of stimuli included such topics as air pollution, water pollution, littering, and symbols of antipollution slogans. It was assumed more feasible to study children's awareness of several common types of pollution, than to do an in depth study of one particular kind of pollution.

Three current environmental symbols and slogans, Smokey Bear, Johnny Horizon, and Woodsy Owl saying, "Give a hoot, don't pollute," were included to determine the impact of advertising campaigns on children. Smokey Bear has long been a symbol used by the Forest Service and has been successful in preventing forest fires (Cordier, 1969). The Bureau of Land Management is trying to get similar results with the use of Johnny Horizon in its environmental campaign, but its effect has been limited since Johnny Horizon doesn't have ready appeal to children and is so recent. In order to find a symbol and slogan that would be meaningful to most of the public the Forest Service has created within the last year, Woodsy Owl saying, "Give a hoot,

don't pollute." These three slogans were presented both visually and verbally, in order to determine children's awareness of pollution due to stimuli presented in the advertising campaigns of concerned agencies.

Pictures

The 18 colored pictures that were included in this study were composed of 12 slides varying in type and degree of pollution, 3 slides depicting symbols of environmental slogans, and 3 slides containing no evidence of pollution. The 12 slides containing pollutant elements were selected on the basis of a pilot study administered to preschool, first grade, and third grade children. Those slides which proved to discriminate pollution recognition and values between the three age levels were included. The nonpollution slides, which were contained in the test for the purpose of disguising the investigator's interest in pollution, were not statistically evaluated. The sources of the slides were scenes photographed by the investigator, pictures from mass media, and slides contributed by colleagues.

The slides were presented to the children in an order which varied the types of pollution, slogans, and nonpollution slides. The slides are listed and described below, in the same sequence which the children were asked to view them in the interview.

Picture Number One--Junk Yard. This picture (Figure 1) includes several wrecked cars with a background of green grass, trees, and blue sky.

Picture Number Two--Trash on City Street. This picture (Figure 2) depicts trash heaped on a city street lined by tenements. Two dolls are visible on top of the trash.

Picture Number Three--Girl Playing by a Stream (Buffer Slide). This picture (Figure 3) depicts a little girl playing by a clear stream containing rocks. The background includes green bushes and an old bridge.

Picture Number Four--Dead Bird on Beach. This picture (Figure 4) focuses on various littered items located on a beach. The litter includes such items as an orange peel, milk carton, sticks, and a dead bird covered with oil.

Picture Number Five--Woodsy Owl. This picture (Figure 5) was photographed from a Forest Service poster of Woodsy Owl, who is dressed in green and holding a whistle. The words on the poster were excluded to eliminate any disadvantage for nonreaders.

Picture Number Six--Plane. This picture (Figure 6) focuses on a plane during take off and its smokey exhaust.

Picture Number Seven--Beach Scene With Children. This picture (Figure 7) is a beach scene showing three children walking along the beach approaching several littered cans. The background includes mountains, a blue sky and lake, and an old boat.

Picture Number Eight--Multicolored Liquid Waste Disposal. This picture (Figure 8) shows the act of water pollution by the disposal of three colors of liquid wastes.

Picture Number Nine--Red Flowers Growing by a Log (Buffer Slide). This picture (Figure 9) shows red flowers growing by an old dead log.

Picture Number Ten--Polluted Water in Front of a City. This picture (Figure 10) shows polluted water in the foreground shading into a city water front of trees and buildings.

Picture Number Eleven--Factory Emitting Smoke. This picture (Figure 11) focuses on a factory and the smoke that is pouring from its chimneys.

Picture Number Twelve--Johnny Horizon. This picture (Figure 12) was photographed from a poster of Johnny Horizon which shows a man in the foreground with fields, mountains, a river, and a city in the background.

Picture Number Thirteen--Picnic. This picture (Figure 13) focuses on two girls having a picnic on a hill overlooking a busy highway and a city with factories emitting dark smoke.

Picture Number Fourteen--Bear in a River (Buffer Slide). This picture (Number 14) shows a bear standing in a river with a fish in its paws.

Picture Number Fifteen--Beach With Litter. This picture (Figure 15) includes a toppled trash can, litter, and sunbathers posed in a background containing water, mountains, and a sandy beach.

Picture Number Sixteen--Shore Scene Containing Polluted Water. This scene (Figure 16) shows a segment of polluted water with green trees, fields, and houses depicted in the background.

Picture Number Seventeen--Smog. This picture (Figure 17) shows a mountain that is barely visible above a smog filled valley.

Picture Number Eighteen--Smokey Bear. This picture (Figure 18) which contains a poster of Smokey Bear on a tree in the woods, was photographed from a current Smokey Bear poster. The name Smokey was removed from the hat to eliminate any possible advantage to those children who could read. The words "Thanks Folks" remained in the picture.

Figure 1. Junk yard.

Figure 2. Trash on city street.

Figure 3. Girl playing by a stream (buffer slide).

Figure 4. Dead bird on beach.

Figure 5. Woodsy Owl.

Figure 6. Plane.

Figure 7. Beach scene with children.

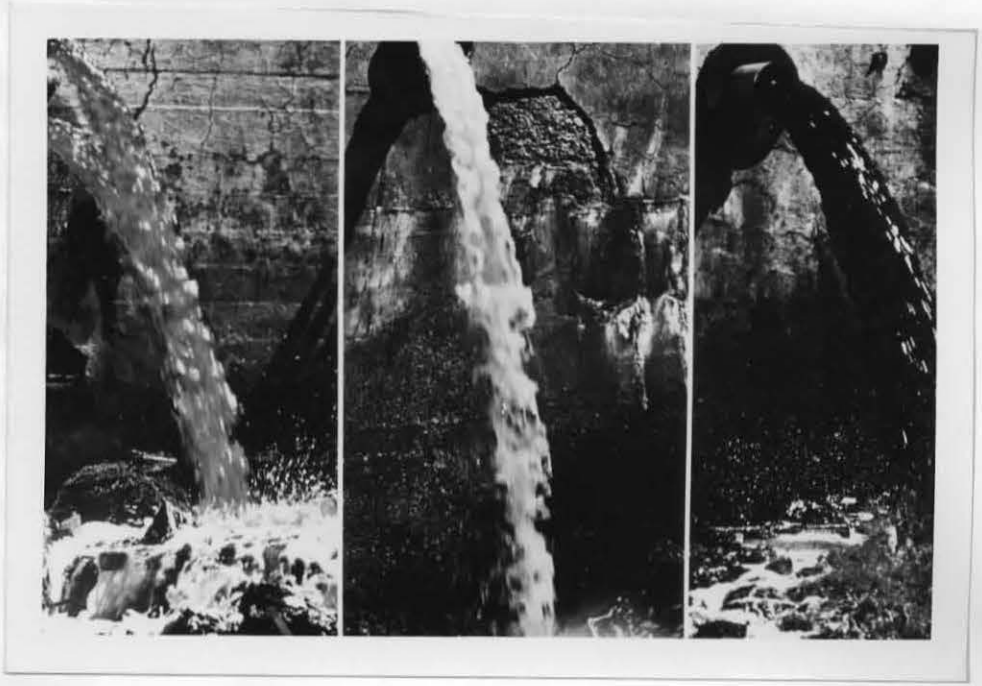

Figure 8. Multicolored liquid waste disposal.

Figure 9. Red flowers growing by a log (buffer slide).

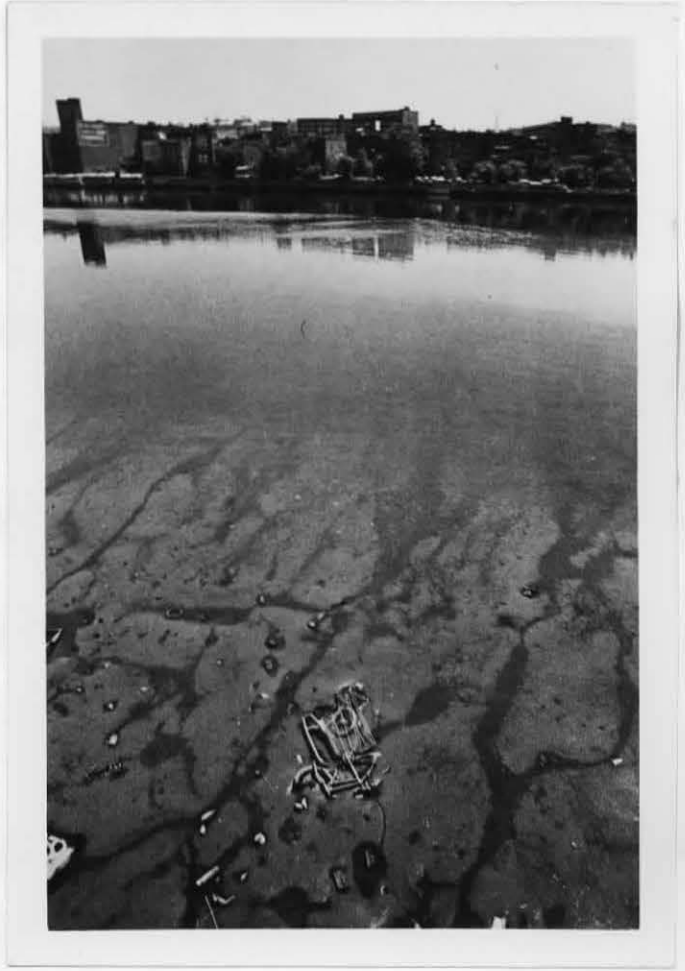

Figure 10. Polluted water in front of a city.

Figure 11. Factory emitting smoke.

Figure 12. Johnny Horizon.

Figure 13. Picnic.

Figure 14. Bear in a river (buffer slide).

Figure 15. Beach with litter.

Figure 16. Shore scene containing polluted water.

Figure 17. Smog.

Figure 18. Smokey Bear.

Words

The nine words or phrases used as verbal stimuli were selected on the basis of findings in a pilot study administered to the three grade levels involved. The pollution words and slogans which were included either proved discriminating or were believed useful for the study. The following list of words is in the same order that was used during the interview: litter, smog, oil spill, environment, pollution, ecology, Smokey Bear, Johnny Horizon, and "Give a hoot, don't pollute." The origin of a child's knowledge regarding the words pollution, ecology, Smokey Bear, Johnny Horizon, and "Give a hoot, don't pollute," was also investigated by asking the child where he had heard about each of these five words or slogans.

Test Administration

Pilot Study

A pilot study was conducted involving children attending the Utah State University Child Development Laboratory and Hillcrest Elementary School in Logan, Utah. The purpose of the pilot study was to determine the best pictures, words, sequence, directions, method of data collection, and length of time to utilize. In addition, it was believed that experimentation was needed concerning adding pictures containing nonpollution subject matter, which might avoid alerting the subjects to the investigator's interest in pollution. The results of the pilot study were incorporated into the actual testing procedure.

The major findings of the pilot study indicated the pictures and words which were discriminating and the necessity of using nonpollution slides as a

buffer to disguise the concept being investigated. The preschool and first grade children didn't need nonpollution slides, but many of the third grade students recognized the underlying concept of pollution, and consequently buffer slides were inserted into the test (Figure 3, Figure 9, and Figure 14). Since a third grade child in the pilot study reported that the bear in Figure 14 was playing in polluted water, the three nonpollution slides which were selected contained questionable elements to formulate a lie scale. Figure 3 contained various rocks in the stream, Figure 9 contained an old dead log, and Figure 14 contained rippled water which lacked visual clarity. Although statistics were not computed on the buffer slides, no child in the actual study described a nonpollution slide as polluted, or appeared to recognize the investigator's interest in pollution.

Setting and orientation

The test was administered at the school which the child attended, and did not include any children involved in the pilot study. The investigator met with each child individually in a separate room, which was made available for this testing. Each child was asked to view some slides with the investigator and was taken to the testing room. Although all first and third grade children were willing to participate, some of the preschool children preferred to remain playing in their classroom. After a child entered the room, he was asked some basic information and given directions, before the room was darkened for the visual segment of the testing. Five to ten minutes were needed to complete each interview.

Slides

A colored slide was presented to the child, and the child was asked to identify what he saw in the picture. If the response was recognition of a single item, he was asked what else he saw in the picture. After the child descriptively reported the contents of the picture, the investigator asked the question, "Would you like to play there?" If the child's reply was merely a positive or negative answer, then a "why" question was asked. Each succeeding slide was presented and assessed in the same manner. Since the pilot study indicated a need for nonpollution pictures, they were randomly inserted and investigated similarly, but not statistically evaluated.

The purpose of the questioning was to bring out in greater depth, the child's environmental perception and values through his verbal responses. The child's environmental perception was indicated by his recognition of pollutant elements, while his value orientation was suggested by his response to the questions, "Would you like to play there?" and "why." The response of those children who would not like to play in the pictured location due to its pollution were used to indicate environmental values regarding pollution.

Words and slogans

When administering the test using verbal stimuli, the investigator asked the child if he had ever heard of the test word. Regardless of a positive or negative response by the subject, the first question was followed by asking the child what the test word meant to him. Each word was investigated in the same manner. The child was also asked where he had heard about each of the last five

words. The purpose of this questioning was to determine the child's understanding of these words and his source of knowledge.

Education unit

Ten preschool children, attending the East Morning Child Development Laboratory at Utah State University, participated in an environmental education unit. These children were presented the identical test, as previously described, both before and after the unit. The length of time between the two test administrations was ten weeks, with the posttest following two weeks after the environmental education unit. Six preschool students in the West Morning Laboratory were also given the identical test ten weeks apart, but this group was not involved in the environmental education unit.

The children's responses in all phases of data collection were tabulated at the time of the interview using the two data collection sheets in Appendix A. Any unusual responses were entered verbatim under the space left for comments. A tape recorder was used to assist recording the comments of any child who spoke too rapidly (Appendix B).

Validity

To determine content validity graduate students and faculty, from the College of Natural Resources and Department of Family and Child Development at Utah State University, were asked to judge the content of pictures and words to be used in the test. The items were evaluated by using the following criteria: type of pollution, quantity of pollution, quality of pollution, and appropriateness to children's perception. After the pictures and words were selected and

approved, these items were presented in the pilot study to determine which pictures and words would prove discriminating between older and younger children. The results from the item analysis of the study sample also indicated that a majority of the pictures and words did significantly discriminate between age groups (Table 9).

Reliability

The reliability of the instrument was controlled for by maintaining constant, the physical environment, testing procedure, and investigator's behavior. The testing environment in each school was a room with minimal visual distractions. In addition, the room was darkened during the slide presentation to allow for visual focusing on the pictorial stimuli. All testing was conducted by the investigator and no interruptions occurred during these sessions. The tabulation was completed at the conclusion of each interview and a tape recording was used to clarify any questionable or incomplete responses.

The behavior and responses of the investigator were other factors that were controlled. Binder, McConnell, and Sjoholm (1957) stress the importance of the interpersonal aspects of the experimenter-subject relationship. According to this view point, the experimenter is a variable and must be considered, since the subject's responses are influenced by his physical and behaviorial characteristics. Krassner (1957) also found various stimuli presented by the researcher, such as gestures, smiling, nodding, and posture, were effective as secondary reinforcers to the subject. Consequently this investigator

attempted to maintain a constant posture, facial expression, and verbal response while testing.

Statistical evidence of reliability was indicated by the nonsignificant change in the test retest procedure used with the preschool control group. The clustering of verbal and visual recognition scores at each grade level also appeared to indicate some consistency in measurement (Figure 19).

Analyses of Data

Frequencies, percentages, and means were used to help tabulate and describe the data in the categories specified on the data collection sheet. Chi square and analysis of variance were employed to determine the significance of the differences among the groups, using the .05 level as the criterion of statistical significance. In addition, correlational techniques were used to compare children's responses to visual and verbal stimuli.

FINDINGS AND DISCUSSION

The significance of sex, age, and environmental education in the development of children's perceptions and values regarding environmental pollution has been investigated in this study. The hypotheses tested included the following:

1. There is a significant difference in the awareness of environmental pollution between older and younger children.

2. There is no significant difference between males and females in their awareness of environmental pollution.

3. An environmental education program significantly increases young children's awareness of pollution.

4. Children who are highly responsive to visual pollution stimuli are also highly responsive to verbal pollution stimuli.

The findings indicated the acceptance of the first and third hypotheses, while the fourth hypothesis was not accepted. Hypothesis number two was the only null hypothesis, and its rejection was not possible.

Hypotheses

Hypothesis 1

The first hypothesis, which stated that there is a significant difference in the awareness of environmental pollution between older and younger children, was accepted. It was believed that visual and verbal recognition of pollution

would increase with age, as well as valuing a clean environment. Recognition and values were indicated by evaluating the responses of children to three categories of the test, which were perception of pollution in colored slides, recognition of words associated with pollution, and environmental values reported while answering the questions, "Would you like to play there?" and "Why?" The responses of those children who would not like to play in the pictured location due to its pollution, were used to indicate environmental values regarding pollution. Table 2 shows the average number of responses by age for each of the three test treatments.

Table 2. Average number of responses on three test treatments for three grade levels

Treatment	Preschool N=20	First grade N=20	Third grade N=20	Total possible score
Pictorial recognition	3.8	8.0	10.7	15
Verbal recognition	.8	3.8	5.3	9
Value orientation (Would not like to play in location due to pollution)	2.1	4.6	7.6	12

The data shown in Table 2 indicate that all three grade levels scored proportionately higher in pictorial recognition than in verbal recognition or value orientation. While the largest increase in pictorial and verbal recognition occurred between the preschool and first grade levels, the largest increase in value

orientation occurred between first and third grade, thereby indicating the precedence of visual and verbal recognition before value formation.

Analysis of variance was employed to determine statistical significance. Tables in Appendix C indicate that for each test treatment, differences between age levels were significant at the .01 level.

It is clear that awareness of environmental pollution and valuation of an unpolluted environment increase with age. Unfortunately, the environmental education provided by the schools could not be held constant, and consequently each grade level had been presented varying amounts of pollution knowledge. Prior to the actual testing, the preschool group had received no specific instruction in environmental education. The first and third grades though, had been involved in the process of learning about environmental problems, but in differing degrees. The first grade class had been studying environmental pollution throughout the year by the use of films, class discussions, and a school newspaper entitled My Weekly Reader, whereas the third grade class had received little exposure to environmental problems. Although these differences in experience did exist, they did not significantly affect age differences in pollution awareness and values.

Within the data recorded for the preschool children, there was little awareness of pollution among three year olds, but as a child approached the age of four, he began to recognize pollution and would not play in polluted places. The preschool group seemed to be most cognizant of slides depicting litter, although Smokey Bear was also frequently recognized. This awareness of litter and Smokey Bear was expected, since children's perceptions are dependent on

past experiences and several visual examples of litter and Smokey Bear are present within the area. The concepts of litter and Smokey Bear are also concrete and more easily learned than subtler types of pollution.

The first and third grade students both displayed increased awareness of air and water pollution, although some minor differences occurred. The third grade showed greater perception of existing pollution, such as smog, while the first grade merely recognized the more obvious acts of pollution, such as smoke emitting from chimneys. Although these age differences exist, the investigator does not attribute age to be the only cause of increased environmental awareness, since the effect of other factors such as social class, intelligence, and parental influence, still need to be investigated.

Hypothesis 2

The second hypothesis stated that there is no significant difference between males and females in their awareness of environmental pollution. It was not possible to reject this hypothesis. There was no significant difference between the sexes in visual recognition of pollution and undesirability of play due to pollution, but there was a significant difference between the sexes in recognition of words relating to pollution.

Analysis of variance was employed to determine statistical significance. Tables in Appendix C indicate nonsignificant differences between males and females in pictorial recognition and value orientation, while male and female differences in recognition of pollution oriented words was statistically significant at the .05 level. However, this significance may be questionable due to the low

number of responses for this treatment. The interaction between age and sex was not significant.

The average number of responses by sex for each of the three test treatments is shown in Table 3. The data not only indicate the low number of responses for verbal recognition, but also the relative lack of numerical deviation between the verbal recognition scores of males and females. Males scored higher in pictorial recognition, while females found it more undesirable to play in polluted locations. Although these differences between sexes exist, they appear to be minimal.

Table 3. Average number of responses by sex for three test treatments

Treatment	Males N=60	Females N=60	Total possible score
Pictorial recognition	4.22	3.75	15
Verbal recognition	1.82	1.48	9
Value orientation (Would not like to play in location due to pollution)	2.33	2.42	12

The relative lack of difference due to sex concurs with Graff's (1962) study of conservation understandings of elementary school children, which found that boys and girls usually differed less than 5 percent in their development of conservation understandings. Although boys were slightly more knowledgeable

about soil and water, and girls were more familiar with plants, both sexes scored similarly with reference to animals.

While females tend to be more adept in language skills, for this test, all three groups of males scored higher in verbal recognition. This finding is in concurrence with Templin (1957), who found that when the language performance of boys and girls is compared over the entire age range, girls tend to receive higher scores more frequently than boys, although the differences are not consistent and are only infrequently statistically significant. A possible explanation for this inconsistency might be related to the content of the verbal recognition test. Active male participation in the area's relative abundance of environmental recreational facilities, could result in a higher male familiarity with words relating to environmental pollution.

Hypothesis 3

The third hypothesis, which stated that an environmental education program significantly increases young children's awareness of environmental pollution, was accepted. Ten preschool children were pretested, presented a four day unit in environmental education, and posttested, to determine the effectiveness of environmental education on preschool children. Table 4 shows the total and mean scores for the experimental group's pretest and posttest.

An environmental education unit was not presented to a control group of six preschool students, although they received a pretest and posttest. Table 5 shows the total and mean scores for the control group's pretest and posttest.

Table 4. Total and mean scores for the preschool experimental group's pretest and posttest

Treatment	Pretest Scores		Posttest Scores		Total possible score
	Total	Mean	Total	Mean	
Pictorial recognition	48	4.8	87	8.7	15
Verbal recognition	3	.3	24	2.4	9
Value orientation (Would not like to play in location due to pollution)	18	1.8	49	4.9	12

Table 5. Total and mean scores for the preschool control group's pretest and posttest

Treatment	Pretest Scores		Posttest Scores		Total possible score
	Total	Mean	Total	Mean	
Pictorial recognition	32	5.3	34	5.6	15
Verbal recognition	7	1.4	10	1.7	9
Value orientation (Would not like to play in location due to pollution)	12	2.0	16	2.7	12

The data shown in Table 4 indicate large increases in scores between the pretest and posttest, but data in Table 5 indicate only a minimal change. Although the sample size was small, the experimental group increased 81 percent in pictorial recognition, 700 percent in verbal recognition, and 172 percent in value orientation, while the control group increased 6 percent in pictorial recognition, 21 percent in verbal recognition, and 35 percent in value orientation.

Chi square was employed to determine statistical significance. The chi square value for the experimental group's change in test scores was 6.83, which was significant at the .05 level. The change in test scores for the control group was not significant as indicated by the chi square value of .40. Although the two groups of children were small in number, these findings indicate the potential importance of environmental education for preschool children, and the need for further investigation.

Since there is little report of any programs or teaching methods, in environmental education, the environmental education unit that produced this change had to be devised by the investigator to coincide with the requirements of the Utah State University Child Development Laboratory, and the needs and abilities of preschool children. The subsequent unit emphasized awareness of environmental pollution by allowing the children to sensorially experience it. The activities, which primarily dealt with litter, due to its relative ease in conceptual understanding, are brefly explained in Appendix D.

The responses of children and parents to the environmental education unit are interesting to report. Children not only responded enthusiastically to

the activities which were presented, but they also applied their classroom learnings by voluntarily picking up trash on the playground. Although this unit proceeded for only four days, this trash pickup continued for two weeks, until the end of school. Parents commented that their children had begun to speak of pollution in the home. The children not only asked parents for additional information, but also were quite insistent that no family member polluted the environment.

Hypothesis 4

The fourth hypothesis, which stated that children who are highly responsive to visual pollution stimuli are also highly responsive to verbal pollution stimuli, was not accepted. Pearson product-moment correlations and scatter plots were performed on the visual and verbal recognition scores, which indicated an increasing correlation at each grade level, but not three consistent and significant correlations. Correlations increased from .39 for preschool children, to .45 at the first grade level, and .68 for third grade students. Only the correlation for the third grade students was considered significant.

It is interesting to note the clustering of scores for the three grade levels (Figure 19). The scores for the preschool children seem quite scattered, but actually over half of the verbal scores are zero. Although 95 percent of the preschool sample visually recognized two or more pollutant elements, only 45 percent recognized one or more pollution oriented words, thereby indicating possible differences in levels or acquisition rates of perceptual and language skills. The increasing correlations of first and third grade students might also

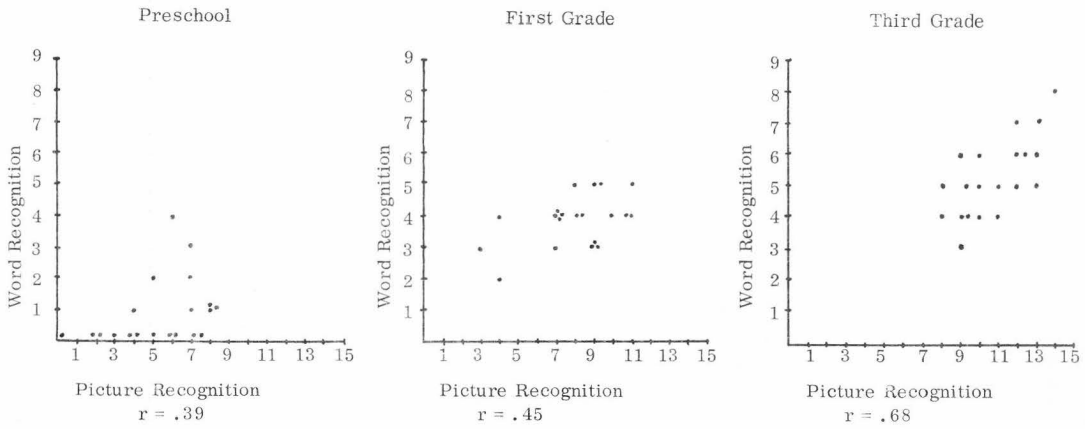

Figure 19. Correlational scatter plots of visual and verbal responses at three grade levels.

be attributed to the acquisition of language skills, since the verbal recognition of first grade students, just learning to read, would not be as high as accomplished readers. Although the findings of this hypothesis indicate an increasing relationship between visual and verbal recognition of pollution, further investigation is needed to determine if this correlation exists for higher grade levels.

Related Findings

Impact of environmental slogans and symbols

The impact of three environmental slogans and symbols was investigated by visually and verbally presenting the following items: Smokey Bear, Johnny Horizon, and Woodsy Owl saying, "Give a hoot, don't pollute." According to Cordier (1969), Smokey Bear has been very valuable in educating the public, especially children. Before the Smokey Bear project began, 210,000 forest fires burned 30 million acres of land every year in the United States. Though five times as many people visit recreation sites today, the annual average has decreased to 100,000 fires and 4 million acres. A considerable number of children involved in this study were knowledgeable about Smokey Bear. All first and third grade students within the sample could both identify a picture of Smokey Bear and explain his purpose. Preschool children were not this aware of Smokey Bear, since only 65 percent of the sample could recognize his picture, and 35 percent of the sample could explain his function. The preschoolers who weren't knowledgeable about Smokey Bear's role in fire prevention, reported that Smokey Bear either loved them, hugged them, played with them, or gave

them honey. The preschoolers also often confused the name Smokey Bear with Yogi Bear, or Pokey Bear.

The recognition of Johnny Horizon's picture and name was not as frequent. According to the Johnny Horizon News-Gram (1971), Johnny Horison's message is now being nationally publicized by appolo astronaut Walt Cunningham, in a school newspaper entitled My Weekly Reader, and even by the comic strip character Snoopy. On the local level Johnny Horizon has occasionally been featured in the comic strips of a Salt Lake City, Utah, newspaper, although only two third grade students could vaguely identify him both visually and verbally.

In contrast, Woodsy Owl, who has only existed for eight months, received greater recognition from the children. None of the preschool children were familiar with Woodsy Owl, while 35 percent of the first grade sample and 20 percent of the third grade sample could identify his picture. This discrepancy in recognition probably resulted from the greater emphasis placed on environmental education by the first grade teacher. The first grade class also read and studied a school newspaper entitled, My Weekly Reader, which featured articles on all three symbols. Some of the effects of My Weekly Reader's contribution to pollution awareness, can be evidenced by the comments of several third grade students, who reported obtaining knowledge of Woodsy Owl by reading first grade siblings' My Weekly Readers. It was also found that verbal recognition of Woodsy Owl's slogan, "Give a hoot, don't pollute," was greater than his visual identification, since 40 percent of both the first and third grade samples were able to recognize and explain his slogan. This increased verbal

recognition might be due to its catchy combination of words, the use of animal symbols which are more easily learned than human sumbols, and the Forest Service's frequent use of radio accouncements to advertise Woodsy Owl.

Due to the effective use of Smokey Bear in fire prevention, two new symbols, Johnny Horizon and Woodsy Owl, have been created to help combat the pollution problem. Although the process of symbol creation is very important, extensive and thorough publicity is also necessary. Smokey Bear has received such publicity, and a reduction in forest fires has resulted (Cordier, 1969). The impact of the two more recent symbols hasn't been as great, as evidenced by the number of children's responses to Johnny Horizon and Woodsy Owl. The role of publicity, however, can definitely be noted by the larger number of responses to Woodsy Owl, the newer and more publicized symbol. Although several inconsistencies have occurred in the past, Tanner (1971) has stated that popular concern for the environment has been both positively and significantly influenced by mass communication. It remains to be seen whether additional public exposure to either or both of these symbols will prove them to be as effective as Smokey Bear.

Sources of pollution knowledge

Due to the recent bombardment of antipollution information from the government, mass media, and schools, the sources of young children's pollution knowledge was investigated. The children were asked where they had heard about pollution, ecology, Smokey Bear, Johnny Horizon, and Woodsy Owl, in order to indicate some of the more effective sources of pollution information.

The responses were tabulated by grade for each suggested source, and are presented in Tables 6, 7, and 8, which contain only the items that received a response.

Since predetermined categories were not presented to the subjects, an increasing number of sources was reported at each grade level. Tables 6, 7, and 8 indicate family, school and television-radio to be among the top three reported sources of pollution knowledge, thereby suggesting their importance in educating young children. Preschool students didn't indicate school as a source of pollution knowledge however, since prior to testing the preschool program did not include it within its curriculum. Graff (1962) also found the school and family to be important sources of students' conservation information, although he found books to be considerably more effective than television as a source of conservation knowledge.

There appears to exist a wide variety of sources of awareness, which even includes pollution knowledge gained by reading cereal boxes. However, the validity of children's responses tends to be somewhat questionable, since several children who recognized Woodsy Owl, attributed their source of knowledge to television, while the Forest Service reported that the Woodsy Owl campaign has not yet been advertised on television. Although the purpose of this survey was not to determine the most effective method of making children aware of pollution, it does indicate both the major sources and the wide variety of sources disseminating pollution knowledge.

Table 6. Sources of pollution knowledge reported by preschool students

Sources	Number of responses per item		
	Pollution	Smokey Bear	Total
Family	2	3	5
Television-radio	1	1	2
Songs		2	2
Signs-posters		2	2
Books-stories		1	1
Parades		1	1
Don't know	1		1

Table 7. Sources of pollution knowledge reported by first grade students

Sources	Number of responses per item			
	Pollution	Smokey Bear	Woodsy Owl	Total
School	8	5	4	17
Family	6	4		10
Television-radio	2	6	2	10
Movies	1	4		5
My Weekly Reader		2	3	5
Visual sights	3			3
Books-stories		2		2
Signs-posters		1		1
Songs		1		1
Friends		1		1
Don't know	6	3		9

Table 8. Sources of pollution knowledge reported by third grade students

Sources	Number of responses per item					Total
	Pollution	Ecology	Smokey Bear	Johnny Horizon	Woodsy Owl	
Family	12	1	6	1	2	22
Television-radio	5		6		4	15
School	5		7			12
Signs-posters	2		6	2	2	12
Movies	1		8			9
Books-stories	2		6			8
My Weekly Reader	1		1		3	5
Newspapers	3				1	4
Friends	3		1			4
Songs	3		1			4
Visual sights	4					4
Magazines	3					3
Cereal box	2					2
Don't know	1					1

Item analysis

An item analysis was conducted on the test items to determine which pictures and words discriminated between the three grade levels' pollution recognition and values. A chi square test was performed on each of the items, employing the .05 level as the minimum criterion of significance.

A majority of the items proved to be significant in determining age differences in pollution awareness. While all pollution slides included in the pilot study indicated possible significant differences, in the actual test, four slides were not significant in discriminating recognition, and one slide was not significant in discriminating value differences. The pictures, which did not elicit significant discriminations in pollution recognition, included two slides denoting litter and two slides depicting water pollution. The slides containing littered items, Figure 2, Trash on a city street and Figure 4, Dead bird on beach, were highly recognized by all three groups. In contrast, Figure 10, Polluted water in front of a city, and Figure 16, Shore scene containing polluted water, were recognized by very few children in each group. Those children who did not recognize pollution in these two water pollution slides, appeared more interested in the desirability of being near water and going swimming.

Since the chi square values for value orientation are predominantly greater than chi square values for pollution recognition, it appears to indicate that the slides were more discriminating between children's pollution values than children's pollution recognition. The one exception is Figure 17, Smog, which had wide differences in recognition of pollution, but fewer differences in value orientation. The children who didn't want to play in the pictured location,

appeared to be more concerned about the apparent lack of activities, rather than the smog.

Only one of the slides depicting environmental symbols did not prove to significantly discriminate between the three age groups. Figure 12, Johnny Horizon, is still relatively unpublicized and consequently very few children recognized him.

The two words which had the highest chi square values were litter and pollution, which were rarely recognized by the preschool children and almost totally recognized by the first and third grade children. The two words with the lowest chi square values include ecology and Johnny Horizon, which were unrecognized by the preschool and first grade children, and only slightly recognized by third grade students. Table 9 shows the chi square values for the pollution slides, symbol slides, and pollution oriented words.

Table 9. Chi square values for item analysis

Test item	Recognition	Value orientation
Pollution Slides		
Junk yard	17.87**	17.38**
Trash on city street	2.50	13.62**
Dead bird on beach	5.78	7.07*
Plane	15.90**	19.80**
Beach scene with children	8.22*	12.92**
Multicolored liquid waste disposal	20.67**	23.77**
Polluted water in front of city	5.73	18.21**
Factory emitting smoke	7.45*	8.19*
Picnic	10.14**	9.99**
Beach with litter	12.51**	15.74**
Shore scene containing polluted water	.53	4.20
Smog	23.23**	12.44**
Symbol Slides		
Woodsy Owl	8.23*	
Johnny Horizon	4.20	
Smokey Bear	15.88**	
Words		
Litter	51.40**	
Smog	27.76**	
Oil spill	15.79**	
Environment	18.63**	
Pollution	37.03**	
Ecology	4.20	
Smokey Bear	33.23**	
Johnny Horizon	4.20	
Give a hoot, don't pollute	10.91**	
		d.f. = 2

*Significant at the .05 level.
**Significant at the .01 level.

SUMMARY AND CONCLUSIONS

Scope of the Study

It has been the purpose of this study to investigate children's awareness and values regarding environmental pollution as related to age and sex. It was also the objective of this study to investigate the relationship between children's responses to visual and verbal stimuli, and to determine the effectiveness of an environmental education program on the awareness and values of preschool children. The following four hypotheses were employed to guide this study:

1. There is a significant difference in the awareness of environmental pollution between older and younger children.

2. There is no significant difference between males and females in their awareness of environmental pollution.

3. An environmental education program significantly increases young children's awareness of pollution.

4. Children who are highly responsive to visual pollution stimuli are also highly responsive to verbal pollution stimuli.

Data for this study were collected by individually interviewing 20 preschool, 20 first grade, and 20 third grade children. The preschool children attended the Utah State University Child Development Laboratory, and the first and third grade children attended Hillcrest Elementary School, which are both located in Logan, Utah. These 60 subjects were presented fifteen colored slides and nine words denoting various types of pollution and environmental symbols and slogans. Three nonpollution slides were added to disguise the

investigator's interest in pollution. In addition, ten preschool children were pretested, subjected to an environmental education unit, and posttested; while six preschool children were pretested and posttested without any involvement in environmental education.

The responses were then subjected to statistical analyses which employed analysis of variance and chi square as tests of significance utilizing the .05 level as the criterion of significance. Correlational techniques and other statistics were used as needed to describe the sample and findings. An item analysis of the pictures, slogans, and words was also conducted using chi square to determine which items discriminated between the three grade levels' pollution recognition and values.

Findings

The findings indicated the acceptance of the first and third hypotheses, while the fourth hypothesis was not accepted. Hypothesis number two was the only null hypothesis, and its rejection was not possible. The major findings are summarized as follows.

1. There was a significant difference in the awareness of environmental pollution between different ages of children. This indicates that for young children, recognizing pollution and valuing an unpolluted environment increase with age.

2. There was no significant difference between males and females in their visual recognition of pollution and value orientation toward pollution.

Contrary to the hypothesis, there was a significant difference at the .05 level between male and female cognitive recognition of pollution oriented words.

3. An environmental education unit was found to influence the environmental awareness of preschool children. The experimental group which was involved in an environmental education unit showed significant increases in environmental awareness, while the control group did not.

4. Although a consistent relationship between the recognition of visual and verbal pollution stimuli was not found, an increasing correlation at each grade level was indicated. The correlation between the recognition of visual and verbal pollution stimuli was only considered significant at the third grade level.

5. Although the influence of Smokey Bear as an environmental symbol and slogan has been considerable, the impact of Johnny Horizon and Woodsy Owl has not been as great, due to their more recent introduction and lack of public exposure.

6. A survey to determine children's sources of pollution knowledge indicated the family, school, and television as the major sources among a wide variety of information disseminators.

7. An item analysis indicated a majority of the test items were discriminating among different ages of young children. Only four of the pictures, slogans, and words showed no signficant discrimination in either the pollution recognition or values of preschool, first grade, and third grade children.

Conclusions

Coping with the pollution problem is a dual task of correction and prevention, although in reality, prevention can be the only long range solution. Prevention will not result from a new scientific formula which will magically remove all pollution, but will evolve from the actions of a concerned citizenry. As previously mentioned, it is difficult for adults to accept new values and behavior patterns, but a belief that is formed as a young child will be the most permanent.

The results of this study indicate that young children become increasingly aware of environmental pollution with age and that environmental education can play a significant role. There has been considerable talk by educators about bringing environmental education down to the preschool level, but little action has resulted. The overwhelming results and responses of preschool children to a unit on environmental education concepts, indicates the need of an action oriented program, which would provide early childhood educators with valuable suggestions for learning experiences. Although it is important to emphasize environmental education in a special unit, environmental concepts need to be included in all educational units and everyday experiences.

This study also indicated that environmental awareness is not characteristic of just one sex, but both males and females. Therefore, opportunities in environmental education should not be singled out for one sex, but should be presented by the organizations and mass media that are of interest to both sexes.

Although dissemination of pollution information needs further investigation, environmental symbols and slogans have been effective in the past, and with additional publicity, new antipollution symbols have high potential. The family, schools, and television have also made notable progress in increasing environmental awareness, but although continued emphasis is needed in these areas, care should be taken not to ignore the wide variety of pollution information sources, which all help to contribute to the increasing development of environmental awareness and values.

Prevention of the pollution problem is definitely an immense, difficult, and lengthy task. But, the continued action of educators, ecologists, and social scientists, in the area of developing environmental concerns and values in young children could well be a beginning to a long range solution.

Suggestions for Further Study

There are several other possibilities for further investigation, although suggestions have been offered periodically throughout this study:

1. Regional investigations of children's awareness of environmental pollution comparing children in large metropolitan areas, medium sized cities, and small rural towns.

2. Determination of the specific effects of environmental education programs for young children, adolescents, and adults.

3. Investigation of peer group influence on environmental practices.

4. Further investigation of the sources of children's pollution knowledge such as parents, television, schools, friends advertising campaigns, etc.

5. Determination of the relationships between children's values and awareness of pollution, compared to the environmental practices of their parents.

6. Comparison of various racial or ethnic differences in children's environmental awareness and values.

7. Comparison of the environmental awareness among low, middle, and upper socio-economic class children.

8. Investigation of the influence of intelligence and personality on environmental awareness and values.

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APPENDIXES

Appendix A: Data Collection

Instructions for Data Collection Sheets

Responses to pictures

Column 1. Recognition of pollution

Place an X in the column if the child recognizes the form of pollution in the picture or a 0 if he does not.

Columns 2, 3, and 4. Reaction to question: Would you like to play there?

Evaluate the child's responses and place an X in the column which best fits his answer; positive, neutral, or negative.

Examples:

Positive	Neutral	Negative
I like to swim	I don't care	No, it's polluted
It looks like fun	I don't know	No, it's messy

Columns 5 and 6. Reason for negative answer

Place an X in the pollution column if the negative reason is due to dislike of pollution, or place an X in the personal reason column if the child's answer resembles the following examples.

No, it's too deep to swim there.

No, I could get my shoes wet.

Comments.

Record any interesting or unusual comments in the space provided.

Responses to words

Column 1. Recognition of word

Place an X in the word recognition column if the child has heard the word before, and a 0 if he has not.

Columns 2, 3, and 4. Meaning of word

If the child can't explain the word place an X in column 2.

If the child can explain the word, place an X in column 3.

If the child explains the word incorrectly, place an X in column 4.

Column 5. Source of child's pollution knowledge

If the child has heard the word and can explain it, record where the child became familiar with the word.

Comments.

Record any interesting or unusual comments in the space provided.

Responses to pictures

Child's name_____ Sex_____ Age_____ Grade_____ Date_____

Pictures and Comments	Recognition of Pollution	Reaction to Question Would you like to play there?			Reason for negative answer	
		Positive	Neutral	Negative	Pollution	Personal Reason
Junk yard						
Trash on city street						
Dead bird on beach						
Woodsy Owl						
Plane						
Beach scene with children						
Multicolored liquid waste disposal						

Pictures and Comments	Recognition of Pollution	Reaction to Question Would you like to play there?			Reason for negative answer	
		Positive	Neutral	Negative	Pollution	Personal Reason
Polluted water in front of a city						
Factory emitting smoke						
Johnny Horizon						
Picnic						
Beach with litter						
Shore scene containing polluted water						
Smog						
Smokey Bear						

Responses to words

Child's name_____ Sex_____ Age_____ Grade_____ Date_____

Words and Comments	Recognition of word	Meaning of Word		
		Could not explain meaning	Explained meaning	Explained meaning incorrectly
Litter				
Smog				
Oil spill				
Environment				

Words and Comments	Recognition of word	Meaning of Word			Source of Pollution Knowledge
		Could not explain meaning	Explained meaning	Explained meaning incorrectly	
Pollution					
Ecology					
Smokey Bear					
Johnny Horizon					
Give a hoot, don't pollute					

Appendix B: Unique Responses of Preschool, First Grade and Third Grade Students

The verbal comments of all three grade levels were similar in content, but differed in sentence length and vocabulary. While preschool children called a picture's content junky or messy, first and third grade students more often formulated complete sentences and used the word pollution. Although most responses merely indicated recognition of pollutant items, some unique responses were given and are reported below.

Preschool students

Some of the unique comments included references to personal danger and a preschool boy's knowledgeable definition of pollution.

It will burn me (factory).

The junk will hurt me.

Smoke will get in my eyes.

It will tear my blanket (trash).

Naughty people put garbage there.

Pollution is trash and litter, and do you know what? It will take oxygen from the fish and they will die.

First grade students

Some of the unique comments referred to death caused by pollution, and personal action in making the environment clean, although some of these action oriented responses would be ecologically questionable.

Factories give smoke. I don't like to breathe smoke because I will die from it.

Trash could kill you. You could hit your head on a can.

The pollution might come down on me (plane's exhaust).

I could take my tractor and push that junk in the water.

I'd float the cans and bottles in the water, and throw rocks so they would sink.

If you litter, the animals will get real mad at you.

Third grade students

The responses of third grade students were usually more complex, involved, and related to personal experience. It is also interesting to note the comments of a girl, who had recently moved to the area from California. Her responses indicated both recognition of pollution and complacency.

People threw things in the water. The tide came in and now the banks are full of what the water used to have. (Response to Figure 10.)

That's a factory polluting the air. It's a nice place to visit, but I wouldn't want to live there. If I always had to wake up to a rotten sky, I would always have to use an alarm clock to wake up by. Up in the sky it would be dark in the morning because of all the polluted air, and I would be late for school.

The air would be polluted and I would have to get shots.

If I breathed there, I would start coughing my head off.

That looks like California where I used to live. I can remember a swell place like that where we used to go on picnics. (Response to Figure 13.)

In California we used to go to a beach just like that. (Response to Figure 15.)

Appendix C: Analysis of Variance Tables for Hypotheses 1 and 2

Table 10. Analysis of variance and means for pictorial recognition comparing age and sex

Source of variation	Degrees of freedom	Mean squares	F test value
Age	2	145.87	32.13**
Sex	1	13.06	2.88
Age x sex	2	1.07	NS
Experimental error	54	4.54	
Total	59		

**Significant at the .01 level.

Table 11. Analysis of variance and means for verbal recognition comparing age and sex

Source of variation	Degrees of freedom	Mean squares	F test value
Age	2	103.55	94.14**
Sex	1	6.67	6.06*
Age x sex	2	.62	NS
Experimental error	54	1.10	
Total	59		

*Significant at the .05 level.
**Significant at the .01 level.

Table 12. Analysis of variance and means for value orientation comparing age and sex

Sources of variation	Degrees of freedom	Mean squares	F test value
Age	2	151.85	32.55**
Sex	1	.42	NS
Age x sex	2	.32	NS
Experimental error	54	6.53	
Total	59		

**Significant at the .01 level.

Appendix D: Summary of Activities in Preschool Environmental Education Unit

The main goals in teaching the environmental education unit to preschool children included the following:

- To determine if children are aware of environmental pollution.
- To help children become aware of the pollution problem.
- To familiarize the children with the process of garbage disposal and removal.
- To help children realize that disposable items can be reused.
- To involve the children in the responsibility of keeping the environment clean.
- To help children enjoy the beauty of nature.

Learning experiences were planned to help implement these goals, and have been briefly summarized by excluding the specific procedures and goals for each activity. The following learning experiences represent only the environmental portion of the unit's activities and do not appear in the order in which they were presented. A complete lesson plan is available from the author.

Movie: "The Litterbug"

The Walt Disney movie entitled, "The Litterbug," was presented to the children.

Flannel board story: Harry the Dirty Dog

The story Harry the Dirty Dog was presented to the children, however, the story was changed, so that Harry became dirty in various polluted places.

Litter bags

The children decorated half-gallon milk cartons using soapy paint and colored tissue paper.

Singing trash can

The titles of songs and fingerplays were written on various items of trash and were placed within a circle of children during a large group acitivy. The children were asked to pick up a piece of trash and place it in a trash can, thereby giving the child a chance to choose a song and experience placing trash in a trash can.

Rhythm band using trash items

The children used various instruments, made from disposable items, in a music experience.

Sculptures from discardable items

Children were shown three sculptures from the Art Department which contained various discardable objects. Disposable items, plaster of paris, scissors, and glue were then provided for small group sculpture assembly.

Visitor and craft activity using cans

While a visitor demonstrated how to reuse can lids, the children decorated cans for use as vases, pencil holders, or banks.

Playing with toys made from cans

During free play children were introduced to the reusability of cans by using them as toys (telephones, stacking cans, and stilts).

Trash masher demonstration

Small groups of children were able to observe another method of trash disposal, the use of a trash masher.

Visitor: Garbage collector and his truck

A man from the University's garbage removal service, told the children about his job, explained where the garbage goes that is in his truck, and demonstrated how his truck lifts garbage into it.

Effect of polluted water on plants

Small groups of children sensorily compared clean water to water which contained dirt, soap, and crude oil. Each group had two plants and throughout the week the plants were watered with the two kinds of water and observed.

Fish tank

During the week a fish tank was in the classroom for the children to observe fish and their need for clean water.

Pollution slide presentation

The children were shown slides to which they could verbally respond "clean" or "polluted." The slides contained pictures of various types of pollution, pictures of their playground and classroom with and without litter, and pictures of the local dump where the garbage collector takes their garbage.

Picnic

The children went on a picnic in Logan Canyon, where they were responsible for disposing their trash and removing litter from the picnic area.

VITA

Carol A. Darling

Candidate for the Degree of

Master of Science

Thesis: Children's Awareness of Environmental Pollution

Major Field: Family and Child Development

Biographical Information:

Personal Data: Born at Virginia, Minnesota, April 13, 1946, daughter of Harry A. and Eileen L. Anderson; married Leslie A. Darling June 29, 1968; no children.

Education: Attended elementary and secondary schools in Virginia, Minnesota; graduated from Roosevelt Senior High School in 1964; received the Bachelor of Science degree from the University of Minnesota, with a major in home economics in 1968; attended graduate school at the University of Maryland, 1969-1971; completed requirements for the Master of Science degree, specializing in child development, at Utah State University in 1972.

Professional Experience: 1972, graduate assistant, Utah State University, Department of Family and Child Development; 1968-1971, Col. E. Brooke Lee Junior High School home economics teacher, Silver Spring, Maryland.