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The Influence of Outdoor Schoolyard Experiences on Students' Environmental Knowledge, Attitudes, Behaviors, and Comfort Levels

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Environmental education has taken many different forms and included a variety of teaching strategies. At the elementary school level, environmental education is often limited to a one- or two-week unit around Earth Day. Most environmental education for K-12 students occurs in the classroom, while teachers, curriculum designers, and researchers often neglect the outdoor learning setting (Orion & Hofstein, 1994).

The outdoors is an effective setting to teach students about environmental issues. As societal institutions, schools can influence behavior, change attitudes, and help students learn about issues that will enhance their abilities to make decisions. Learning activities in the outdoors that are designed to develop greater insight into ecological relationships and the need for maintaining the quality of the environment should be an integral part of school curricula. Researchers have found that students can effectively learn about environmental and science issues in outdoor settings at least as effectively as in the classroom (Bogner, 1998; Cronin-Jones, 2000; Disinger, 1986; Falk, Martin, Wade, & Balling, 1978; Harvey, 1989-1990; Howie, 1974; Lisowski & Disinger, 1991; Shepard & Speelman, 1986).

Outdoor experiences have the potential to impact students in both the cognitive and affective domains (Crompton & Sellar, 1981; LaForgia, 1988; Meredith, Fortner, & Mullins, 1997; Orion & Hofstein, 1994). In their review of 34 research studies in environmental education, Leeming, Dwyer, Porter, and Cobern (1993) found that most of the studies focused on changes in attitude, knowledge, or both, but few of the studies addressed changes in behavior. The authors found this trend disturbing because "it is ultimately behavior change that is required to preserve environmental quality" (p. 10). There is no consensus among researchers on the relationship between the three domains. Some believe that behaviors are influenced by affective factors, and others believe behaviors are influenced by cognitive factors (Millar & Tesser, 1989); however, separating the two as influences eliminates potential contributions of the other.

Hines, Hungerford, and Tomera (1986-1987) conducted research on students' environmentally responsible behaviors. Variables in their study that correlated with some indicator of responsible environmental behaviors included verbal commitment, locus of control, attitude, personal responsibility, and knowledge.

They concluded that approaches addressing both the cognitive and affective domains offer the most effective means of helping individuals develop environmentally responsible behaviors. Most of the 15 studies analyzed by Hines et al. (1986-1987) supported including both knowledge and attitudes in an environmental education program in order to ensure the transfer to environmental actions. In their review of environmental education research, Volk and McBeth (1998) found that attempts to increase ecological and environmental issue knowledge resulted in favorable outcomes as well as fostering responsible environmental behavior and its determinants.

Much of the research on outdoor education has focused on field trips to parks or nature preserves and on outdoor experiences in residential centers (Falk et al., 1978; Kostka, 1976; Ohkawa, 2000; Orion & Hofstein, 1994; Rath & Brown, 1996). Field trips to parks or nature preserves can expose students to unique outdoor settings, but some documented problems associated with field trips include lack of adequate funding, liability concerns, transportation costs and logistics such as time constraints and distance (Ham & Sewing, 1987-1988; McCaw, 1979-1980). There are also problems with relying on field trips to give students a full, meaningful exposure to environmental issues. The isolated experiences of field trips prevent long-term observations such as seasonal or weather-related changes or interactions. Students cannot manipulate variables or observe the effects of changes over the course of time. Research on student learning in novel outdoor settings, such as field trips, has shown that students learn less than in more familiar outdoor settings (Biggs & Tap, 1986; Leftridge & James, 1980; Martin, Falk, & Balling, 1981; Orion & Hofstein, 1994).

Continuous, repeated activities with recognizable natural surroundings can have a stronger effect on student learning than occasional experiences in novel natural areas. Ford (1986) supported using the outdoors on a consistent basis: "Outdoor education must be taught at all levels and pursued throughout life." (p. 10). Even though she described outdoor education activities as being found most frequently in elementary schools when compared to high schools, the experiences are often not continuous. Shepard and Speelman (1985-1986) concluded from their study on outdoor experiences and the affective domain that "program length does appear to have an effect on developing positive environmental attitudes" (p. 22); and Armstrong and Impara (1991) found that environmental education programs may be very effective if used on a regular basis and at regular intervals.

Harvey (1989-1990) supported the use of school grounds as a solution to the problems associated with field trips. She promoted using the school grounds because "they can be continuous (daily), qualitative (if combined with classroom instruction), and of long duration (a student's entire school career)" (p. 10). Cronin-Jones (2000) examined the effectiveness of using the schoolyard to teach students about ecological concepts and to develop more positive attitudes toward natural settings and their inhabitants. She found that elementary students learn more through outdoor schoolyard experiences than through traditional classroom experiences.

In their review of environmental education program research, Crompton and Sellar (1981) concluded that one of the most important variables in an environmental education program's success may be the length of exposure to natural environments, and Bixler, Carlisle, Hammitt, and Floyd (1994) purported that repeated positive exposure to outdoor areas can eventually lower the novelty of such areas and build a sense of environmental competence. Falk (1983) found that repeated visits to a site often produced the best results for students of all

ages, but especially for younger students. The design of this study incorporated both regular intervals and continuous exposure to the outdoors through the use of the schoolyard. The school grounds provide a readily available and practical means for achieving the goals of continuous exposure to the outdoors at regular intervals.

Research Method

This study was designed to examine the effects of participation in regular outdoor schoolyard environmental education activities on environmental knowledge, attitudes, behaviors, and comfort levels of fourth- and fifth-grade students. It was hypothesized that a curricular program which included regular, schoolyard experiences consisting of knowledge, attitude, and behavior-related activities would have a positive impact on students' environmental knowledge, attitudes, and personal behaviors toward the environment. It was further hypothesized that participation in outdoor schoolyard activities would affect student comfort levels in outdoor settings.

A quasi experimental, pretest/posttest, nonequivalent group design was used because it was unfeasible to randomly assign students to treatment or control groups for this study (Cook & Campbell, 1979). Subjects from both the treatment and control groups completed pretests and posttests for each of the four dependent variables: (1) environmental knowledge, (2) environmental attitudes, (3) environmental behaviors, and (4) comfort level in the outdoors. Analysis of Covariance (ANCOVA) was used to control for differences in pretest scores. One class received the outdoor schoolyard treatment for the 14-week study period. The second class served as the control group. The control group teacher included a unit during the 14-week study period covering general environmental education concept lessons but without schoolyard activities.

Study Sample

The hypotheses were tested with students from four intact classes at an elementary school in north-central Florida in the second semester of the school year. The treatment group consisted of one fourth- and one fifth-grade class. There were 33 students in the fourth-grade treatment group class and 23 fifth-grade students in the treatment group class. The control group consisted of one fourth- and one fifth-grade class. There were 24 students in the fourth-grade class and 24 fifth-grade students in the control group class. The socioeconomic makeup of the school included students from low to high socioeconomic levels, with the majority of the students coming from low- to middle-income families.

Instruments

Because of a lack of existing and reliable instrumentation, the author designed three of the four instruments used in this study regarding the specific outcome variables examined in this study. The researcher-designed knowledge and behaviors instruments were based on the Children's Environmental Attitudes and Knowledge Scale (CHEAKS) (Leeming, Dwyer, & Bracken, 1995), and the comfort-level instrument was a researcher-designed questionnaire.

In order to assess the reliability of the three researcher-designed instruments, a pilot study was conducted with a convenience sample, consisting of an intact

class of 30 fourth-grade students not participating in the research study. Test-retest reliability was assessed by administering each test to the pilot test group twice, with a four-week interval between test administrations and with no treatment. The Pearson correlation was used for analysis resulting in a coefficient of 0.97. Internal consistency analysis estimated test score reliability by examining the individual items on the test. Cronbach's coefficient alpha was used for computing test score reliability with a score of 0.59.

Internal consistency analyses estimated test score reliability by examining the individual items of the tests. Cronbach's coefficient alpha was used for computing test score reliability (see Table 1). The internal consistency scores were 0.59, 0.82, and 0.69 for knowledge, behavior, and comfort level, respectively. The knowledge instrument score of 0.59 is a source of loss of power. The researcher considered removing certain items from the instrument, but determined that the score would not increase enough to justify the decrease in test length. In addition, removing items would alter the Table of Specifications correlations. Pilot test scores can be found in the table below.

Table 1
Pilot Test Reliability Scores

Instrument	Test-Retest	Internal Consistency
Knowledge	0.97	0.59
Behavior	0.81	0.82
Comfort Level	0.65	0.69

N = 30

Readability analyses of the instruments were measured using a Fry readability assessment (Fry, 1969). The readability of the instrument was determined to be appropriate for the study. Content validity of the instrument was determined through a review by a science education university professor and an entomology professor to review entomological content. Each reviewer supported the content and organization of the instrument.

The Children's Attitudes Toward the Environment Scale (CATES), developed by Musser and Malkus (1994), was used to measure attitudes. This instrument was selected because it measures general environmental attitudes and met the goals of the study. In addition, its developers had already established the reliability of the instrument. The Cronbach's alpha for internal-consistency reliability of the scale was .70 and the test-retest reliability was .68, $p<.0001$.

Activities

The schoolyard activities were selected from a variety of established environmental education curricular sources including *Outdoor Biological Instructional Strategies* (OBIS) (1982), *Project WILD* (1986), *AIMS – Activities Integrating Math and Science* (1989), and *The Schoolyard Wildlife Activity Guide* (Cronin-Jones, 1992). The activities were classified as knowledge, attitude, or behavior-related activities by the researcher. The science/environmental concept topics included habitats, adaptation, interdependence, classification, and schoolyard organisms.

The students in the treatment group participated in schoolyard activities once a week for the 14-week study period. Typical knowledge activities had students observing trees, conducting inventories of soil samples, or comparing plots in

sunny and shady locations. A typical attitude activity required students to assess the influence of humans on their environment and address attitudes and comfort levels regarding organisms in the schoolyard. Each of the lessons culminated with a time for discussion or sharing. Heimlich (1993) recognized the importance of creating learning settings that allow for diverse interpretations of the physical environment in order to enhance learning outcomes.

Six reviewers, three for science content (university faculty in biology, entomology, and botany) and three for pedagogical content (two elementary science teacher specialists and a university faculty member in science education) reviewed the activities for content validity. The reviewers supported the overall curriculum package, and questions about appropriateness of grade-level expectations were addressed. The researcher and the treatment group teachers discussed solutions in pretreatment conferences.

A Treatment Fidelity form that the treatment group teachers filled out upon completion of each activity was used to enhance the researcher's knowledge of external factors affecting each treatment activity when the researcher was unable to observe the class. The form included a section for the teacher to list external factors that may have affected the activity's results such as weather conditions, unusual school events, or unusual schoolyard or classroom interruptions. There were sections for teacher observations and student reactions.

Qualitative Data Sources

Triangulation involves using multiple methods to collect data. Fraser (1991) recommended the triangulation of qualitative and quantitative methods to enhance the credibility of the results. This study incorporated qualitative data from interviews and observations to enrich the quantitative dataset. The teachers administering the treatment completed a Treatment Fidelity form that contained a brief checklist about students' reactions to the treatment and also an area for additional teacher observations after implementing each schoolyard lesson. This form allowed the teachers to record their observations about individual students' reactions to the treatment experience and about the conditions on the day of each activity. The researcher conducted post-study interviews with the treatment group teachers to supplement the data from the Treatment Fidelity forms. In addition, the researcher observed six of the 14 activities and completed Treatment Fidelity forms to compare with the teachers' forms.

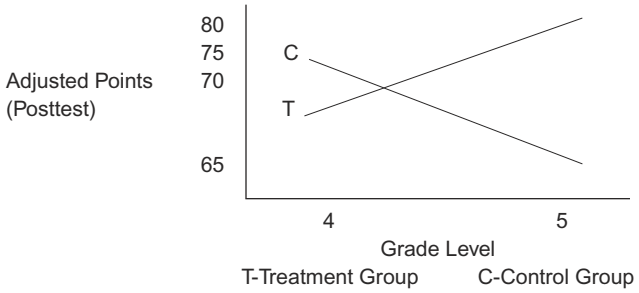
Post-treatment interviews were also conducted with the students to augment data from the comfort-level questionnaire and allow the researcher to include additional observations on students' feelings and emotions that may not have been expressed in the self-report questionnaire. The researcher conducted the brief (5- to 10-minute) interviews with each of the students after the completion of the treatment activities. Some elementary students can effectively express their feelings and comfort levels with a prepared instrument, while others may be more expressive in an interview. The researcher recorded the interviews both using audio recordings and writing the students' comments. The themes and analysis of this qualitative portion of the research emerged from the data rather than being imposed prior to data collection. According to Patton (2002), the inductive search for patterns is guided by the research questions and motives of the researcher. The researcher analyzed the students' comments and organized the responses to find major categories of the students' degrees of comfort in the outdoor settings.

Results

The adjusted mean posttest scores for the fourth- and fifth-grade treatment groups were higher than the adjusted mean posttest scores for the fourth- and fifth-grade control group for each of the four outcome variables: (1) environmental knowledge, (2) attitudes, (3) behaviors, and (4) comfort levels in the outdoors. Only two analyses revealed statistically significant results, however.

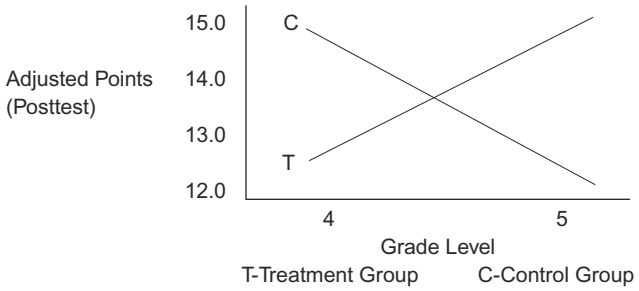
1. There was an interaction between grade and treatment in the measure of environmental knowledge, indicating a significant difference between the fifth-grade treatment group students (see Figure 1) when compared to the control group.

Figure 1
Environmental Knowledge



2. There was an interaction between grade and treatment in the measure of comfort level, indicating a significant difference between the fifth-grade treatment group students (see Figure 2) when compared to the control group.

Figure 2
Comfort Levels



3. There were no significant differences in the fifth-grade treatment and control group posttest scores in the measure of environmental attitudes or behaviors.

An analysis of the adjusted posttest scores led the researcher to investigate potential gender differences for each of the dependent variables: environmental knowledge, attitudes, behaviors, and comfort levels. Significant differences

between male and female scores were found in the fifth-grade treatment group for environmental attitudes and behaviors. In each case, the females' adjusted posttest scores were significantly higher than the males' scores.

Fifth-grade females scored an average of 5.6 points higher than males for environmental attitudes after adjusting for initial differences in the pretest scores. These gender differences were significant: F = 5.27, p-value - .0265. The adjusted scores were Males = 69.8 and Females = 75.4.

On the environmental behaviors instrument, fifth-grade females scored an average of 5.7 points higher than males after adjusting for initial differences in the pretest scores. These gender differences were significant: F= 9.59, p-value = .0034. The adjusted mean scores were Males = 58.7 and Females = 64.4.

Conclusion

The fifth-grade treatment group showed statistically significant differences in the measures of environmental knowledge and comfort levels when compared to the control group. There were no significant differences between the fourth-grade treatment and control groups. In addition, significant gender differences were found in the fifth-grade treatment and control groups. The females showed significantly higher scores in the measures of environmental attitudes and behaviors when compared with the males.

The significant differences in the fifth-grade treatment group with regard to environmental knowledge and comfort levels in the outdoors, as well as the significant gender differences in the fifth-grade treatment group with environmental attitudes and behaviors, indicate the potential for the effective use of the schoolyard for environmental education activities.

Discussion

The conclusions in this study led the researcher to examine some potential factors affecting the results. The students' maturity levels might have influenced the differences in the fourth- and fifth-grade treatment groups. The effects of the two treatment group teachers could have played a role in the findings of the study. In addition, there were significant differences found regarding gender in the measure of environmental attitudes.

Maturity Level

There were no significant differences between the treatment and control groups for the outcome variables in the fourth-grade sample. The different levels of maturity of the fourth-grade students when compared to fifth-grade students may have been a factor influencing the results of this study. Students in elementary school are in various developmental levels—some in a more concrete developmental stage, while others are approaching or have achieved, an abstract or formal level of reasoning (Piaget, 1932). Environmental issues are interwoven with knowledge, attitudes, and the resulting behaviors. Many are value-laden and require students to use abstract and complex thought processes, so students' developmental levels could affect their abilities to internalize outdoor experiences and translate them into effective knowledge, attitude, and behavior development.

Teacher Effect

While students' individual developmental levels may have contributed to the lack of significant differences in the fourth-grade treatment group, another explanation could be teacher's effect. Leeming et al. (1993), in their meta-analysis of research in environmental education, discussed methodological issues of using existing groups of subjects, most commonly entire classes of students. Individuals in a class or other intact group do not constitute independent measures, and their responses may be affected by numerous confounding factors other than, or in addition to, any true treatment effect. Potentially confounding factors when using different classes include differences in teachers and different interactions among students within a class. The result is a greatly increased probability of a Type I error.

The lack of significant differences found in the quantitative data of the fourth-grade treatment group in this study, combined with the researcher's observations, interviews, and discussions with the treatment group teachers, indicated a recognizable difference in the levels of enthusiasm for environmental issues of the two treatment group teachers. For example, in the post-study interviews, many of the students in the fourth-grade group described an outdoor experience during one of the activities of the treatment when the class saw a snake. The teacher had not reported this on the Treatment Fidelity form, even though there was a place on the form for the teachers to describe any unusual or unexpected events for each activity. It was apparent from the students' comments that the experience made a distinct impression on the class. When the students talked about the experience, the researcher asked about the reactions of the students and the teacher. Most reported the students' excitement and anxiety, but they said that the teacher simply instructed the students to keep away and move on and did not use the opportunity to discuss the snake or its habitat. Eighty-seven percent of students who had a fear of an animal named snakes as their most frightening animal, and one explained that snakes "make you sick or kill you." These students wrote about their fears of snakes biting them.

In his study on the evaluation of the affective domain, LaForgia (1988) warned, "teachers behaviors may be more influential than curriculum variables" (p. 412).

An analysis of teacher interviews and questionnaires illustrated certain changes necessary to promote the expansion of environmental education in elementary schools. It is important to promote the idea that environmental education is not an addition to the existing program, requiring a loss of valuable time, but rather an inclusion of activities designed to meet existing subject area objectives.

In this study, the teachers commented that they and the students were frustrated by their inability to label the organisms during their schoolyard activities. One goal of teacher training should be to help teachers break the perceived role of the all-knowing source of information in the classroom. The fifth-grade treatment teacher's responses in interviews and the Treatment Fidelity forms showed a more thoughtful and creative approach, a willingness to learn with the students, rather than dictating, controlling, or dispersing the knowledge. When teachers assume the role of a learner, an effective relationship is possible between the teacher and students.

Gender Differences

The differences in fifth-grade gender-related environmental attitudes found in this study are interesting because Iozzi (1989) reported inconsistent gender effects in his review of research on environmental attitudes. Hofman (1977) found no significant differences between 8-year-old boys and girls in eight of ten categories, but there were significant differences in girls' responses with questions regarding plants and animals, and boys were significantly different in the category of experimentation. Leeming et al. (1993) cited studies that documented a higher sensitivity toward the environment for female subjects. In a review of research on knowledge, affect, and the environment, Zimmerman (1996) cited studies that described a pattern of gender differences. Females report stronger feelings and verbal commitment, and males display a greater knowledge about environmental issues.

In this study, an interesting interaction between age and gender effects may explain why the fifth-grade female students showed significant environmental attitudes and behaviors. Future research to examine the relationship between gender and age would further explore this connection.

Student Comfort-Level Interviews – Post Study

Additional data were collected through interviews with the students in the treatment groups following the outdoor activities. Students in the treatment groups expressed a positive feeling about the outdoors and an enthusiasm for the inclusion of outdoor activities during the school day. Comfort-level interviews were conducted during the week following the posttests. The researcher, who recorded the students' responses using both audiotape and notes, conducted the interviews.

Distinct patterns were apparent in the students' responses. In the fourth-grade treatment group, 24 of the 33 students reported positive feelings about their schoolyard learning experiences. The students who said they felt comfortable in the outdoors used descriptive words such as "fun, exciting, different, and interesting." Twelve students reported that the change in routine was the most welcome aspect of the activities.

Eighteen of the 33 students in the treatment group said they were not frightened of animals or conditions in the schoolyard setting. Nine of the 13 students who reported fears or discomfort named spiders or snakes. Six students reported fears of stray dogs, bears, bees, or mosquitoes.

Some of the students' responses to the comfort-level questionnaires or interviews indicated an interesting variety in their images of environmental situations. Many students described feeling comfortable with a lot of trees around them because they felt "safe" or "guarded" by the trees. Other students said that they felt comfortable with trees around them but with reservations because they "help you hide." Two students described their discomfort with lots of trees because they worried about trees falling on them or their houses during storms. Twelve students described trees as beneficial because they "give you oxygen."

One question asked if the students spent time watching or touching trees. One student responded, "Touching trees makes people think you're gay." Many said that trees are "boring," but more than 75% of the students reported that trees were "relaxing" or "felt good," or they were "used to them." One student wrote, "Yes, because I feel that every tree deserves a good friend."

When asked if students would feel comfortable sleeping outdoors, one student said that he would sleep outdoors, but "if I do I will have a gun and a stick with me." Another student said, "Yeah, to let the owls make me fly into dreamland because their sound puts me to sleep." One student described the sounds in the outdoors as "a song in the air" and another used the expression "music to my ears."

Students who reported fears of certain animals named a wide variety of animals, many that seemed surprising or unfounded. One student wrote that porcupines "scare me to death" and another named bulls as being very "scary looking." Another described a fear of frogs because, "One day I dreamed a frog took my video games and then killed my family. There was a question that asked if the students enjoyed watching animals, and one student replied, "Yes, squirrels, because they taste good." Another question asked if students were comfortable looking at spiders, and one student replied, "Yes, because spiders are animals and they can't help the way they look."

The students' overall positive responses could have been attributed to the presence of the researcher during the interview and the students' desire to please the researcher, or they may have been due to an increase in fluency the students may have felt giving verbal responses. Students' written responses on the questionnaire have the potential to be more thoughtful or more cumbersome, depending on the dexterity of the student. This is another reason for including alternative data collection.

Summary

The results of this study are limited to the generalizations with this population only; however, more research on the use of the schoolyard could contribute to its potential for effectiveness. A similar study conducted with students in second and third grades would enhance the data of this study. Environmental education begins early in elementary school, and the combined data of research using students in various developmental levels would enhance schoolyard research efforts. The influence of maturity levels could be addressed by combining data of more studies at various elementary grade levels.

Future research efforts on the impacts of the schoolyard environmental education experiences need to control for teacher effect. The logistics of designing a study that separates students in self-contained classes so a teacher can teach students in both the treatment and control groups is complex. Educational researchers have many goals, one of which is to provide a naturalistic setting that can be easily replicated. The part of the treatment that is less replicable is the instructor's style of teaching. One potential solution for this dilemma involves teacher training and preparation to achieve consistency in the presentation of the curriculum. Armstrong and Impara (1991) warn, however, that imposing strict control on teacher behavior when evaluating the effectiveness of a curriculum may produce a biased estimate of the curriculum's effectiveness. A large study sample consisting of many teachers might help address this issue of teacher effect.

Significant gender effects for the fifth-grade students' environmental attitudes and behaviors indicate further research studies that examine gender differences in environment-related studies. The inclusion of students at various levels in elementary school would contribute to the dataset for gender differences.

The small study sample limits the power of the analyses, but the results of this study indicate the potential benefits of using the schoolyard for continuous outdoor

experiences. Elementary school is the prime time to develop lifelong curiosity and a sense of purpose for environmental awareness, and regular schoolyard activities can provide an opportunity to help develop and nurture these goals.

Sarah Carrier Martin has taught elementary school for 14 years and has taught both elementary and middle school science methods courses at the University of Florida. Her special interest in environmental science and her experiences with children and the outdoors led her to conduct research using the schoolyard to help students learn about and appreciate the outdoors.

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