ABSTRACT

A CORRELATIONAL STUDY OF NATURE AWARENESS AND SCIENCE ACHIEVEMENT

An Action Research Project

Presented to the

Department of Teacher Education

Johnson Bible College

In Partial Fulfillment

Of the Requirement for the Degree

Master of Arts in Holistic Education

By

Kelly Chandler and Monica Swartzentruber

May 2011

ABSTRACT

As part of a pilot program, the researchers sought to develop an instrument that would effectively measure the nature awareness of students. With this information, the researchers correlated nature awareness scores and science averages.

According to Salomon and Perkins' theory of transfer, experiences in one situation can influence experiences in other situations. Experience (in this study) deals specifically with encounters with nature. Following a structure made by Kellert (2002), as cited in Davis, Rea, and Waite (2006), the researchers chose to evaluate direct experiences, indirect experiences and vicarious experiences in nature. As a result of the connection between nature and the science curriculum, the researchers chose to assess a correlation for the students' nature awareness scores and science averages. The purpose of this study was to determine if the theory of transfer as presented by Perkins and Salomon (1988) relates to students' experience in nature (as determined by nature awareness score) which in turn correlates to their science averages.

Two groups of fourth grade students were studied (one from a suburban school and the other from an urban school). This study included 56 4th grade student participants. Each student completed the Nature Awareness Survey, and the researchers compiled a Nature Awareness Score for each student. Then the researchers calculated the students' third nine week science averages. The researchers applied a Spearman's rho and a Pearson correlation in order to determine if a significant correlation existed. The results of the study revealed significant data to support the proposed hypothesis.

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APPROVAL PAGE

This research proposal by Kelly Chandler and Monica Swartzentruber is accepted in its present form by the Department of Teacher Education at Johnson Bible College to institute the action research project requirements for the degree Master of Arts in Holistic Education.

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Chapter 1

Introduction

When educators teach about nature without connection to nature experiences it is similar to “having the illusion of conducting heart surgery without knowing what a real heart looks like” (Dayton & Sala, 2001, p. 200). Utilizing nature experiences may enhance science instruction by promoting transfer of informal learning situations to greater understanding of classroom content material. With this in mind, the researchers sought to gain insight concerning the connection between a students’ nature awareness and their science grades.

Past Research

Overall, little research on this specific topic exists. However, the idea of learning from nature has a rich history. Louis Agassiz, a teacher in 1807, challenged his students to learn from direct experiences in nature (McCrea, 2006). Also, in the 1930s during the Great Depression, conservation education became more prevalent since it received support from both government and non-government organizations (McCrea, 2006). In addition, educator John Dewey promoted a student-centered philosophy coupled with holistic education to provide an integrated approach to learning. As the years progressed, environmental education began to gain momentum with the passing of the National Environmental Policy Act of 1969 which emphasized taking care of the environment (McCrea, 2006). Over the past 30 years countless projects, research, councils and conferences have addressed the growing need for environmental education and conservation.

Research indicates an increasing focus on environmental education (Crisp, 2010; Ernst, 2007; McCrea, 2006); however, research linking environment-based learning with students' science achievement proves more difficult to locate. Nonetheless, research concerning environmental education supports the connection between experiential education in nature and success in the classroom. The following research suggests that environmental education produces encouraging learning outcomes. The National Environmental Education Advisory Council (NEEAC) reports:

> Educators across the nation are reporting that their students are performing at higher levels, getting better test scores, learning how to think more critically, and building the quality of their character. These reports are backed up by research illustrating that environmental education has become a valuable tool in improving learner achievement. (NEEAC, 2005, p. 13)

This research signifies the effectiveness of environmental education, though it does not provide specific evidence of a student's nature awareness contributing to success in the classroom.

Exploring science education provides some helpful information on this topic. Successful science education fosters learning through experience by promoting hands-on activities as well as informal learning environments. Gerber, Cavallo, and Marek (2001) studied the results of an informal educational project. Their study of seventh grade students indicates, "Students with enriched informal learning environments scored significantly higher on the Classroom Test of Scientific Reasoning (CTSR) than students with impoverished informal learning environments" (Gerber et al., 2001, p. 544). Studies such as this one help confirm a relationship between informal learning experiences and science achievement.

Shortcomings of Past Research

Research on several components of this project exists, but a reliable instrument that indicates a relationship between students' nature awareness and science grades does not exist. The development of this instrument could eventually generate valuable information and insight for effective teaching methods. Past research focuses on structured environmental education programs and their effects. In this study, however, the researchers measured the benefits of students' unstructured and informal encounters in nature. The available research does not provide sufficient information on the specific topic of interest.

Audiences

The results of the research could be advantageous to both educators and parents. Information on a significant correlation between nature awareness and science achievement could benefit the entire educational community. This research may encourage administrators to recognize and utilize the informal learning environments available in the school district, and it may persuade classroom teachers to draw from the students' informal nature experiences in order to foster transfer of information. In addition, parents may begin to consider the correlation between their child's nature experiences and science grades. Since parents actively influence their children's learning, they could make an effort to provide their children with informal learning opportunities inside and outside the home. Research on this topic may provide the motivation some parents need to be more involved in their children's learning.

Purpose Statement

The researchers sought to test the theory of transfer as presented by Perkins and Salomon (1988) which led the researchers to believe students' experience in nature (as determined by nature awareness score) relates to their science grades. The researchers controlled for the grading period, grade level, and geographical region for fourth grade students at two East Tennessee schools.

Definitions of Terms

For the purpose of this study the researchers chose to define the following important terms:

Environmental education. Environmental Education (EE) is designed to take the content that is learned and apply it to the real world environmental issues and problems in order that they might be a part of the solution as citizens of their environment (Fisman, 2005).

Informal learning. Informal learning refers to activities that occur outside the school setting, that are not developed primarily for school use, that are not developed to be part of an ongoing school curriculum, and that are characterized by voluntary as opposed to mandatory participation as part of a credited school experience. Informal learning experiences may be structured to meet a stated set of objectives and may influence attitudes, convey information, and/or change behavior (Crane, Nicholson, & Chen, 1994, as cited in Hofstein & Rosenfeld, 1996).

Inquiry-based learning. **"**In an inquiry approach to science, children focus on questions about the natural world, collect data through their own investigation activities, and, with teacher assistance, use their data as evidence to answer their questions” (Carin, Bass, & Contant, 2005, p. 7).

Nature awareness. Nature Awareness is “children’s ecological knowledge and their awareness of the form and features of their local environment” (Fisman, 2005, p. 40). The researchers focused on the aspect of “nature” that refers to flora, fauna, soil, water resources, rocks, etc.

Outdoor education. “The instructional use of natural and built areas to meet student learning objectives in a variety of subject-matter disciplines through direct experiences” (Knapp, 2006, p. 1831).

Science averages. The average science grades were recorded by the researchers at their prospective schools. They were recorded at approximately the same time in the school year depending on the pace of science instruction at each school. The content covered during the science classes at each school varied.

Transfer of knowledge. Transfer occurs “when something you learn in one situation affects how you learn or perform in another situation” (Ormrod, 2008, p. 391).

Assumptions

The researchers assumed all students were qualified for fourth grade, and the students honestly and accurately indicated their nature awareness information on the given survey.

Hypothesis

The research hypothesis read as follows:

H_1: Nature awareness scores are significantly correlated to science grades.

Limitations

The participants were from four fourth grade classes in East Tennessee. Two classes were located in a mainly urban area elementary school, and the other two classes were located in a mainly suburban area elementary school. This field study used a small, nonrandom sample. The parents of the students gave permission for their students to participate in this study. Furthermore, the length of time was confined to the third nine-week grading period for participant study and data collection. The graded science topics varied in content between the two schools; however, both schools adhered to fourth grade Tennessee state standards for science.

Chapter 2

Review of the Literature

This literature review focuses on learning in nature and science education. First, the theoretical foundation for this project is identified. Second, an examination of scholarly literature concerning the first review topic of nature awareness is presented. This section includes matters such as environmental education and nature learning. Third, research on the second review topic of science education and achievement is explored. This section includes aspects such as reflection, informal learning, inquiry, and experience-based learning. Fourth, an investigation of the third review topic concerning the relationship between topic one and topic two is presented. This section consists of several case studies which reveal a connection between the first two topics. Fifth, a concise summary of the findings is provided.

Theoretical Foundation

Theory of transfer. Authentic education seeks to connect prior knowledge to newly presented information (Corbit, 2008; Krajcik & Sutherland, 2010). Genuine learning does not occur until the information truly becomes part of the learner's wealth of knowledge and understanding. This concept provides the basis for the theory of transfer. In order to learn something new, students transfer what they already know to the new scenarios in which they learn. The previously acquired knowledge must be adapted to fit into the new context.

D. N. Perkins and Gavriel Salomon (1988) significantly contributed to the development of this theory. The theory of transfer explores how information learned in one context influences learning in another context. Individuals in a problem situation identify specific elements of the situation and look backward into their experiences for beneficial and relevant information. This process is referred to as backward-reaching high road transfer (Perkins & Salomon, 1988). This theory leads the researchers to expect experiences in nature to influence or explain science achievement because experience in nature promotes backward-reaching high road transfer in understanding science concepts taught in the classroom.

Transfer of knowledge project. Basile (2000) sought to determine if participation in an outdoor nature investigation program significantly impacted students' ability to transfer knowledge. Basile (2000) believed students often do not have the experience or schema they need to understand science content taught in the classroom. Therefore, her hypothesis proposed students who participated in an environmental education program would greatly benefit from the experience because significant transfer occurs as a result of the hands-on learning. This study involved 45 third grade students from an urban elementary school. Half of these students participated in the Nature at Your Doorstep program, and the other half served as the control group. A pretest-posttest control group design was used for this study. Basile (2000) used a Knowledge Indicator Instrument to identify the students' aptitude for transferring declarative, procedural, and schematic knowledge to a group of both near and far transfer situations. Near transfer refers to the application of information learned in one situation to another similar situation. Far transfer involves the application of learned information to new and different situations. The results of this study indicate no significant difference between the two groups' near transfer of knowledge. However, the results do show a statistically significant difference between the two groups' far transfer of knowledge. Thus, outdoor education was found to be effective for both near and far transfer of learning.

Constructivist Background. Although Perkins and Salomon's theory of transfer provides the main theoretical background for this research project, the theory of constructivism supplied the foundation for the theory of transfer. Jean Piaget (1965), forerunner of Perkins, offers the foundation of constructivism in his book *Child's Conception of the World*. In this book, Piaget (1965) discusses stages children move through, and he explains how children take in the world around them which reveals how they process information. Piaget (1965) asserts that children, age nine or ten, construct their concept of what is "alive" based mainly on movement (p. 221). Thus, Piaget's stages promote a better understanding of fourth grade students' perspective and awareness of the natural world.

Perkins (1991b) offers an overview of technology and constructivism. As a part of this overview, he describes characteristics of rich learning environments. Rich learning environments affect how students process information. Perkins (1991b) discusses the benefits of phenomenaria, one characteristic of an enhanced environment. Similar to physical simulations, phenomenaria build conceptual understanding through experimentation. Perkins (1991b) suggests, "Environments for science learning commonly highlight phenomenaria" because using a discovery approach allows students to build their own understanding (p. 19). By emphasizing this aspect of rich learning environments, educators could encourage constructive science learning through real nature experiences.

Nature Awareness

Reasons for environmental education. As the world population continues to heavily contribute to the problem of pollution, environmental education (EE) programs continue to focus on the solutions to such problems. Coyle (as cited in NEEAC, 2005) notes, “Americans can correctly answer fewer than 25% of the basic environmental literacy questions asked” (p. 9). This statement provides a case for the necessity of environmental education, a component of nature awareness. The *National Environmental Education Advisory Council* (NEEAC) proposes a connection between environmental education and environmental literacy by stating, “Environmental education enhances lifelong learning skills, including critical thinking, problem-solving, collaboration, and decision-making” (NEEAC, 2005, p. 10). Using the outdoors whenever possible as a setting for learning also remains a central component of environmental education (NEEAC, 2005).

Furthermore, EE’s importance surfaces when testing teachers and their connection with nature. Ernst (2007) conducted a survey of K-12 teachers to determine why certain teachers utilize environment-based education successfully and others do not. One component of the survey considered the teachers’ environmental sensitivity with questions about their “frequent contact with nature as a child” (Ernst, 2007, p. 22). The results of this study indicate a teacher’s environmental sensitivity strongly influences his/her receptiveness to and successful implementation of environment-based education. These results further support nature awareness as a significant component of environmental education. If teachers’ childhood experiences in nature affect their later environmental awareness, one could theorize nature awareness would have a similar effect on student learning.

EE covers a breadth of topics, all of which relate to the natural world. Environmental education recognizes the need to address students who spend more time indoors than outdoors (Crim, Desjean-Perrotta, & Moseley, 2008). Some key pieces of environmental education include:

> An understanding of systems, interdependence, the importance of where one lives, the integration and infusion of concepts across the curriculum, the use of real-world experiences for understanding, and the need for such lifelong learning skills as critical thinking and decision-making. (Crim et al., p. 8)

A need for environmental literacy concerning environmental citizenship also exists. On this note, Griset (2010) stresses the importance of environmental citizenship and helping students take nature learning to an action level. Environmental citizenship exists as a central component of environmental education. Griset (2010) believes, “Incorporating an ‘action’ component into a field-based curriculum brings a course full circle. Students apply what they have learned to a real problem and begin to make a difference” (p. 45). Environmental education facilitates the production of students with an awareness of the natural world and a motivation to take responsibility for the upkeep of their world.

Benefits of environmental education. Environmental education offers limitless benefits, but this literature explores only a few benefits. EE deals with a process that occurs in learning. Davis, Rea, and Waite (2006) studied the Forest School program in order to explore the effects of outdoor education on students ages 3-11. This school strives “to build on an individual’s innate motivation and positive attitude to learning, to offer children opportunities to take risks and make choices and to initiate learning for themselves" (Davis et al., 2006, p. 5). One of the principles drawn from the Forest School study suggests learning occurs when it is not simply based on classroom objectives. Using nature in learning promotes acquisition of process knowledge in addition to content knowledge. However, the authors claim the "residential fieldwork can lead to greater cognitive learning outcomes than classroom based activities" (Davis et al., 2006, p. 7). This environmental program also promotes "learning *from* rather than *about* nature" (Davis et al., 2006, p. 6).

Ernst and Stanek (2006) studied the Prairie Science Class (PSC) in order to identify further benefits of informal environmental education programs. PSC seeks "to provide environmental education programs that support science/environmental literacy" (Ernst & Stanek, 2006, p. 263). This study involved 50 fifth grade students who participated in PSC and 40 fifth grade students who were not involved in PSC. The researchers used Minnesota Comprehensive Assessments in Math and Writing, affective self-report surveys, parent surveys, and stakeholder interviews to determine their results. The results of this study indicate "a positive, statistically significant increase in students' assessments of their science process, problem solving, and technology skills, as well as their skills in working and communicating with others ($p<.01$)" (Ernst & Stanek, 2006, p. 259). The authors mention several compelling reasons to foster informal environmental education programs. First, they suggest "repeated encounters with the natural world facilitate the familiarity and provide the time required to develop in-depth understanding and influence one's values, beliefs, and sense of responsibility" (Ernst & Stanek, 2006, p. 263). Second, they believe, "As course content is connected to the local environment, the traditional lines between basic subject areas are blurred and a complexity develops that is not often found in discipline-bound textbooks or learning activities" (p. 263).

EE programs allow students to become involved in the community. A local environmental education program, Ijams Nature Center in East Tennessee, serviced over 3,500 students during the 2009-2010 school year through interactive field trips available through the Science Discovery Program. This program complements science learning in the classroom by constructing "an educational opportunity that allows students to see the pages of their text books come to life" (Moore, 2010, p. 2). Moreover, another East Tennessee organization acknowledges the educational benefits of nature within the context of National Parks. Parks as Classrooms, specifically in the Great Smoky Mountain National Park, uses nature to integrate instruction from Kindergarten to eighth grade. From the beginning of the program, students are made aware of the natural resources available in the park. By the end of the program, eighth graders have experienced environmental stewardship that is applicable to their learning environment (Crisp, 2010). Furthermore, within the scope of local nature connections, Griset (2010) validates the effectiveness of using the community when studying environmental education. She notes in her explanation of her field ecology course, "fieldwork lends itself to taking advantage of community expertise" (p. 43).

The students impacted by EE also contribute to the success of the community. Often as a result of EE, students gain an appreciation of their surroundings. Fisman explains:

> EE built around wilderness experiences might actually diminish environmentally responsible behaviors among suburban participants because these programs tend

to reinforce the separation of pristine nature and the students' home environments. This finding implies that teaching children about the positive aspects of their local environment would build their sense of caring and connection to the place where they live. (Fisman, 2005, p. 39)

Environmental education fosters an appreciation and understanding of one's surroundings. EE should be integrated through allowing the students to take ownership of a relevant problem. Some examples of integration in EE are ecology garden explorations, food composting programs, recycling efforts, water analysis projects and protection for state wetlands (Paterson, 2010). These projects allow the students to identify local issues and become actively engaged in the solution.

Finally, EE allows students to interact with nature in a unique manner. Experiential and outdoor education allows students to assimilate to their surroundings. This aspect of EE promotes "activities that immerse young children in their natural environment, where they can experiment, ask questions, hypothesize, and draw conclusions" (Crim et al., 2008, p. 8). In a gardening project done with young gifted students, the authors note that when "creating a habitat for small creatures, bugs, insects, and birds, children gain a chance to learn first-hand about the natural world" (Pfouts & Schultz, 2003, p. 57). Educators must address the individual needs of the student, but environmental education offers benefits for all students.

Learning in nature. Although many people assume experience in nature occurs easily and frequently, scientific evidence suggests "not all people learn spontaneously from nature and that much of what we would like learners to learn is not obvious or commonsense" (Brody, 2005, p. 604). According to Brody (2005), several important aspects encourage teachers along the path of nature: “direct experiences, cognition, personal and social learning, affective development and time” (p. 604). Brody (2005) concludes these components satisfy “essentials of human experience” which he notes are “thinking, feeling, and acting” (p. 605). This kind of human experience can be encouraged in the home if the teacher assigns “unstructured time” (Olson & Drake, 2009, p.53) outdoors as science homework. With this kind of learning supported by the family, the student is able to bring back knowledge to the classroom which will enrich the classroom experience. Therefore this kind of exploration should be used “for the purpose of data collection, not concept introduction” (Olson & Drake, 2009, p.53). This partnership is ultimately designed to “foster the child’s curiosity” (Olson & Drake, 2009, p.53) in nature.

As far as learning in nontraditional or “informal settings,” Brody notes both “the learner’s relevant background knowledge and his or her existing internal conceptual framework” are factors (Brody, 2005, p. 605). Furthermore, Brody simplifies his theory of learning in nature as “meaningful learning in nature is a result of direct experience(s) over time in which personal and social knowledge and value systems are created through complex cognitive and affective processes” (Brody, 2005, pp. 610-611).

Even though we note positive connections and benefits with nature, some students experience negative connections and associations with nature and the outdoors. In a study done by Fisman (2005), she notes that in areas of low socio-economic status, students did not want to go outside because they were afraid of being shot (p. 47). This attitude towards nature offers a challenge for environmental education. Therefore, Fisman (2005) concluded, “there is a lack of opportunity to apply and reinforce what they are learning to the 'real world'" (p. 47). Limitations exist in environmental education, but the goal of transferring science knowledge from one context to another remains despite the occasional setbacks.

Science Education and Achievement

Challenges to science education. The No Child Left Behind Act (NCLB) has created particular challenges for science learning. The Center on Education Policy (CEP) published a report in 2007 detailing some of the changes made in schools because of NCLB. The CEP surveyed 491 school districts and performed case studies in 43 school districts to acquire their data. The results from their study suggest since the majority of standardized tests consist of English language arts and mathematics, other subjects (e.g. science) often receive less instruction time and emphasis in the classroom. Since NCLB was established, the CEP reported an increase in English language arts and mathematics instructional time and a decrease in instructional time for all other subjects. In fact, the report states science instructional time decreased by 76 minutes per week on average (McMurrer, 2007). The CEP acknowledges the dilemma of this decline in science learning time. They suggest teachers focus on integrating the subjects so science and social studies remain priorities for student learning.

Misunderstandings about environmental education create another challenge to science education. Many educators see EE as something extra to squeeze into an already busy school day. Ernst (2007) suggests a more collective acceptance of environment-based education may reverse the concern that EE "competes for instructional time in the core subject areas" (p. 29). In the concluding remarks of Ernst's study, she paraphrases Franklin (2004), as cited in Ernst (2007), by proposing, "Implications of today's accountability era and its emphasis on state standards and testing have frequently led to teaching subject areas in isolation, a textbook-oriented curriculum, and a tendency to abandon programs that are viewed as extracurricular despite their valuable learning opportunities" (Ernst, 2007, p. 29). Ernst also seems to promote subject integration as a means of overcoming some challenges facing science education.

Activating prior knowledge. Research emphasizes the effectiveness of using students' prior knowledge to promote learning new content (Donovan & Bransford, 2005; Rupley & Slough, 2010). Students often know about science concepts, but they simply forget or fail to connect this past knowledge to new experiences. Rupley and Slough (2010) believe, "Background experiences enable students to develop, expand, and refine the concepts that words represent within the context of science" (p. 100). The authors also believe, "the experiences [students] have extend, reinforce, and stimulate them to engage in deeper processing of scientific concepts" (Rupley & Slough, 2010, p. 109). Students without prior knowledge of certain scientific concepts can learn new information, but Rupley and Slough (2010) suggest previous experience provides an enriched context for science learning. In the aforementioned study completed by Brody (2005), the researcher focuses on two aspects of informal learning: "prior knowledge and opportunity as well as the link between prior knowledge and connecting new information with our everyday lives" (p. 606). Thus, Brody (2005) also acknowledges the importance of students' prior knowledge in learning.

Krajcik and Sutherland (2010) offer several instructional techniques which can aid in students' science literacy. One of these techniques suggests linking new ideas to prior knowledge and experiences. These authors explain the necessity of eliciting prior knowledge by stating, “Prior knowledge forms a cornerstone of all subsequent learning, and eliciting prior knowledge becomes especially important when concepts are abstract, when scientific principles seem distant from students’ everyday lives, and when students’ experiences lead them to develop inaccurate ideas” (Krajcik & Sutherland, 2010, p. 457). Therefore, Krajcik and Sutherland (2010) encourage educators to bridge science content with students’ prior knowledge which they note can stem “from either real-world experiences or previous classroom learning” (p. 457). This connection requires a focused effort from the classroom teacher. Corbit (2008) explains the critical nature of activating students’ prior knowledge by stating, “If students are not allowed to draw from their repertoire of information and to use their background knowledge to frame a topic their chances of relating, comprehending, and internalizing a lesson are diminished” (p. 23). Thus, Corbit (2008) proposes, “Jogging the mind to touch on previous learning or knowledge, also known as a ‘schemata,’ helps students organize information from past experience and sets the stage for future understanding” (p. 23). Eliciting students’ experiences and prior learning promotes deeper understanding.

Learning science through reflection. Several methods for teaching science exist and offer significant means for student learning. McDonald and Dominguez discuss the benefits of gaining science understanding through reflection. They suggest students often do not connect classroom learning with real world scenarios. Students need the opportunity to make personal connections with science topics; the method of reflecting provides such an outlet. McDonald and Dominguez (2009) mention allowing students to “record thoughts, observations, feelings, activities, and questions in a journal” (p. 39) throughout science projects. These techniques can allow teachers to gain insight into students' actual understanding of science topics. In addition, students who engage in reflective thinking utilize what they already know to identify what information they need to learn and how they need to learn it (McDonald & Dominguez, 2009, p. 39). This article suggests if students express their knowledge through reflection, teachers can use this information to build on students' prior knowledge and experience and focus on more difficult scientific concepts.

Inquiry. Many researchers consider the method of inquiry a successful instructional technique (Church, 2000; Hoisington, Sableski, & DeCosta, 2010). Hackling, Smith, and Murcia (2010) believe, "students need to be engaged in making sense of science activities and new ideas in terms of their existing knowledge and experiences" (p. 17). One method of inquiry instruction is the 5Es inquiry model. This formula of science instruction allows students to engage and explore first using their existing knowledge. Teachers encourage students to ask and attempt to answer questions on their own. Teachers also ask questions but do not offer direct answers. This inquiry model, according to Hackling et al. (2010), allows students to "construct understandings and make sense of experiences using their prior knowledge and through conversations with others" (p. 18). A study constructed by Metz (2008) emphasizes the need for inquiry instruction by commenting, "The elementary science curriculum tends to skip quickly from one topic to the next, with little opportunity for children to 'prob[e] deeply' into the 'details' of any domain" (p. 140). Furthermore, Metz (2008) concludes students gain knowledge as they take responsibility for their own investigations and identify questions of personal interest to them (p. 158). These articles suggest interactive and inquiry-based science learning fosters deep understanding of the content and enhances students' scientific literacy.

Gerber, Cavallo, and Marek's (2001) study of seventh through tenth grade students also sought to discover a relationship between classroom teaching experiences and students' science reasoning skills. The authors focused on the experiences of inquiry and non-inquiry science instruction. Teachers who emphasize the learning cycle and student-discovery activities were considered inquiry science teachers. The authors state, "The development of reasoning abilities is promoted through students' experiences, cognitive conflict, and social interactions. In inquiry classrooms, teachers help the children engage in many of the same mental activities that occur in informal learning environments" (Gerber et al., 2001, pp. 538-539). In their study they found scores on the Classroom Test of Scientific Reasoning (CTSR) indicate students in inquiry classrooms had higher science reasoning abilities than students in non-inquiry classrooms (Gerber et al., 2001, p. 545). This study advocates inquiry science instruction specifically for students who do not have informal learning opportunities.

Informal learning. Learning does in fact take place outside the school classroom. Researchers describe informal learning as:

> Activities that occur outside the school setting, that are not developed primarily for school use, that are not developed to be part of an ongoing school curriculum, and that are characterized by voluntary as opposed to mandatory participation as part of a credited school experience. Informal learning experiences may be structured to meet a stated set of objectives and may influence attitudes, convey

> information, and/or change behavior. (Crane, Nicholson & Chen, 1994, as cited in Hofstein & Rosenfeld, 1996, p. 3)

The extent of informal learning is yet to be determined. Researchers have attempted to verify the effects of informal learning on students' abilities and achievement. Gerber et al. (2001) agree, "[formal] schooling teaches general skills and knowledge that are hopefully transferable to outside school" (p. 547). Sometimes "hopefully" is not good enough. Informal learning allows students to experience real life situations which do provide useful schemata for formal learning. Braund and Reiss (2006), in their article about out-of-school learning, suggest, "Practical science in out-of-school contexts is more 'authentic' than much of what goes on in school laboratories" (p. 1378). Of course, an educator's desire involves students participating in genuine learning experiences, and Braund and Reiss believe this can and should take place in and outside the school building.

Osborne and Dillon of the Centre of Informal Learning and Schools offer a set of papers detailing how "much, if not more, learning takes place in the social and cultural contexts that are offered outside school" (2007, p. 1441). In this study, over 475 informal science institutions in the US were surveyed in order to determine their best practices. Osborne and Dillon (2007) mention this as a goal for the Centre of Informal Learning and Schools:

> To address pressing problems confronting K-12 science education by focusing on key components of the infrastructure that supports science education, including informal science institutions, and building programmatic bridges between out-of-school and school science learning" (p. 1442).

This editorial advocates students gaining knowledge outside school. Osborne and Dillon suggest research on learning in formal contexts exists much more widely than research on learning in informal contexts. Thus, they believe more studies on informal learning situations need to transpire.

Nevertheless, a balance must be maintained between formal and informal learning. Braund and Reiss (2006) suggest informal learning provides a complementary tool for education and should not exist as a substitute for formal education (p. 1375). Unfortunately, many people fail to acknowledge the many benefits of informal learning. Braund and Reiss (2006) believe, "educators tend to ignore, or at least play down, the crucial influences that experiences outside school have on pupils' knowledge and understandings, and on their beliefs, attitudes, and motivation to learn" (p. 1375). Ramey-Gassert (1997) also asserts that informal learning in science is disregarded by many professionals (p. 433). These articles suggest students' experiences beyond the classroom play a critical role in learning.

Hofstein and Rosenfeld (1996) also provide a collection of research concerning the positive effects of informal learning. They discuss five modes of informal learning: school-based field trips, student projects, community-based science youth programs, casual visits to museums and zoos, and the press and electronic media. From these modes of informal learning, the researchers identified positive effects such as significant cognitive learning on field trips, improved attitudes toward science learning, significant learning opportunities, and ability to outperform other students on skills tests (Hofstein & Rosenfeld, 1996). Of course, limitations exist with each informal learning mode as well.

However, this article supports the use of informal learning experiences as a tool to enhance science learning.

Informal educational projects. Gerber et al. (2001) designed a study to discover a connection between students' science reasoning abilities and their informal learning environments. The authors studied 1,178 seventh through tenth grade students from eight middle schools in the Midwest. The students answered a 41-item questionnaire to determine whether they experienced an enriched or impoverished informal learning environment. Then they completed the Classroom Test of Scientific Reasoning (CTSR). The results from this study indicate "students with enriched informal learning environments scored significantly higher on the CTSR than students with impoverished informal learning environments" (Gerber et al., 2001, p. 544). The results from a study by Brody (2005) show, "Informal education activities, particularly visits to museums, were considered to have natural advantages such as nurturing curiosity, improving motivation and attitudes, engaging the audience through participation and social interaction" (p. 606). These results suggest informal learning activities impact student learning and performance in the classroom.

Experienced-based learning. Young Achievers Science and Math Pilot School provides students with a learning program that integrates the mandatory curriculum with "authentic local explorations of nature" (Connors & Perkins, 2005, p. 29). Three hundred urban students from Kindergarten through eighth grade participate in this school each year. The founders of this pilot school believe engaging student curiosity about the natural world inspires students to "apply scientific inquiry to their daily world as a tool for better understanding the larger, natural/scientific and manufactured/technical world they live in" (Connors & Perkins, 2005, p. 31). Connors and Perkins (2005) discovered, "learning by doing enhances knowledge acquisition, but also…learning through physical activity appears to be a more productive way for some children to learn" (p. 31). Learning from nature allows students to become involved in their community while gaining experience with the science curriculum.

Ballantyne and Packer (2009) studied 199 students and 23 classroom teachers from Queensland, Australia in order to determine the most effective strategies for learning in natural environments. Students and teachers were observed and interviewed in order to acquire the data necessary for the study. The results of this study indicate students learned 49% of the material through experience, 31% through teacher explanation, and 20% through a combined strategy (Ballantyne & Packer, 2009). Their research led them to believe, "Learning experiences in natural environments have been associated with increased levels of student motivation and achievement (Battersby, 1999), as well as a greater likelihood that learning will be transferred to situations that students encounter outside of the school environment (Ballantyne, Fein, and Packer 2001b)" (Ballantyne & Packer, 2009, p. 243). Thus, experience-based learning appears to be the most effective method for learning in nature.

Relationship Between Nature Awareness and Science Education

Several studies indicate a relationship between the aforementioned topics of nature awareness and science education. Many of these case studies support the specific connection between environmental learning and its influence on science test scores.

Research suggests environmental education produces noteworthy learning outcomes. The *National Environmental Education Advisory Council* supports environmental education programs by claiming:

> Educators across the nation are reporting that their students are performing at higher levels, getting better test scores, learning how to think more critically, and building the quality of their character. These reports are backed up by research illustrating that environmental education has become a valuable tool in improving learner achievement. (NEEAC, 2005, p. 13)

Furthermore, this council asserts "not only did the students' performance improve on traditional measures of competence—earning higher grades and scoring better in reading, math, and writing—but their interest and motivation were also enhanced" (NEEAC, 2005, p. 13). As referenced by the NEEAC, the National Environmental Education and Training Foundation reviewed different case studies which produced interesting discoveries. These studies report "students performed better in science" and "developed the ability to make connections and transfer their knowledge from familiar to unfamiliar contexts" after participating in an environmental education program (NEEAC, 2005, p. 14).

Connors and Perkins (2005) discuss the success of their Young Achievers Science and Math Pilot School located in Boston, Massachusetts. The foundation of their school stems from their belief about how "grounded field experience about natural systems at [the students'] age will give them an absolute advantage in science classes later on" (Connors & Perkins, 2005, p. 31). They continue by stating, " We also believe that the ability to make connections between that experience and a body of knowledge such as science is often the necessary catalyst in producing a confidence with the material that triggers an interest in higher education" (Connors & Perkins, 2005, p. 31). This school promotes learning from the world rather than learning about it. Connors and Perkins (2009) present three successful aspects of using natural experiences in science education. First, this method promotes a love for science. Second, they note "improved standardized tests scores and other academic skills by aligning an experience-based science curriculum with the kinds of questions and intellectual strategies found on state-wide standardized exams and grade-level core subject math and science material" (Connors & Perkins, 2009, p. 59). Third, teaching science through real-world experiences encourages student wellness through kinesthetic learning. Furthermore, the results of this school's program indicate improvement on science test scores and in other areas of academic ability.

Braund and Reiss (2006) advocate for school and home initiated learning. They assert, "If the pay-off from out-of-school learning of science that is integrated within a more authentic science curriculum is more engaged and positively oriented science students, then school learning must surely benefit" (Braund & Reiss, 2006, p. 1379). They offer five advantages of participating in out-of-classroom learning: "improved development and integration of concepts, extended and authentic practical work, access to rare material and to 'big' science, attitudes to school science, stimulate further learning, social outcomes: collaborative work and responsibility for learning" (Braund & Reiss, 2006, p. 1376). These advantages suggest the vast array of knowledge students can and do acquire outside the classroom affect their performance in science class.

Lieberman and Hoody (1998) studied environment-based education programs which use the Environment as an Integrating Context for learning (EIC). The natural world offers countless opportunities for learning, and studies like this one explain the many benefits of utilizing this valuable learning framework. This method of environmental education advocates “interdisciplinary, collaborative, student-centered, hands-on, and engaged learning” (Lieberman & Hoody, 1998, p. 1). The researchers gathered data from 40 schools, 400 students, and 250 teachers and administrators. Their findings indicate schools using the EIC method of instruction demonstrated several educational benefits in language arts, math, science, etc. Using the EIC, students demonstrated an “increased knowledge and understanding of science content, concepts, processes, and principles” (Lieberman & Hoody, 1998, p. 6). A greater ability to apply knowledge of science to real situations, increased proficiency in observing, collecting data, analyzing, and drawing conclusions exist among other benefits of using the EIC (Lieberman & Hoody, 1998, p. 6). Perhaps most relevant to the purpose of our research, this study reports, “EIC students scored higher, on three of four comparative studies of standardized science achievement data, than their peers from traditional programs. In the fourth comparative study, EIC and traditional students scored equally” (Lieberman & Hoody, 1998, p. 6). This data supports the notion that environmental awareness and education enhance science achievement.

Irvin (2007) presents a success story about using the environment as a context for learning. In 1999, Oil City Elementary School in Louisiana received a school performance score of 40.4 out of 100. In 2001, Irvin and his team created a school program based on the EIC model discussed by Lieberman and Hoody. Since implementing this program, Irvin claims, “Classroom instruction has dramatically changed since we incorporated the environmental focus throughout the school’s curriculum. Gone is reliance on text-books, as they have been replaced with hands-on activities and inquiry learning" (Irvin, 2007, p. 55). Threats of closing Oil City Elementary School surfaced until they capitalized on the benefits of outdoor classrooms and experiential learning. Irvin summarizes the positive results in this way:

> Both inside and outside the school, Oil City's approximately 385 students and 28 teachers are engaged in hands-on, environmentally focused learning that has boosted test scores, increased attendance, and spurred parent and community involvement—all in a Title I school whose dwindling enrollment targeted it for closure just five years ago. (Irvin, 2007, p. 54)

In 2006, Oil City received a school performance score of 89, which exceeds the state average (Irvin, 2007). Obviously, using nature experience to facilitate science learning enhances student achievement.

In an evaluative review, Blair (2009) reports the effects of experiential education on students' attitudes, science achievement, and behavior. The author specifically examined the positive student outcomes as a result of school gardening. Schools tested these gardening projects with 3^{rd}-6^{th} grade students. This review also supports the research by Lieberman and Hoody because 9 out of the 12 gardening projects studied indicate a positive impact on science achievement for students who participated in gardening as an integrated context for learning (Blair, 2009). School gardening projects seem to provide excellent opportunities for students to interact with nature while learning content specific skills. While many reasons to participate in school gardening exist, this review proposes academic achievement in science as the most common reason for maintaining school gardening projects (Blair, 2009, p. 34). Blair closes the review by reemphasizing, "The results of qualitative, quantitative, and survey research have supported the conclusion that school gardening can improve students' test scores and school behavior" (Blair, 2009, p. 35).

Summary

Nature and science learning seem to easily fit together. The articles reviewed in this project present nature awareness as an often neglected but extremely important feature in children's education. Richard Louv (2008) suggests involvement in nature "help[s] children understand the realities of natural systems through primary experience" (p.92). Research presented in this review indicates the benefits of learning in nature. In fact, the articles concerning science education and achievement suggest significant learning occurs when students draw from personal experiences and participate in learning in informal settings. Furthermore, Rupley and Slough (2010) suggest, "In order to acquire new science information, students must bring previous knowledge and experiences to their reading and learning" (p. 105). This connection between prior informal learning and new learning supports the significant notion of transfer of learning. It seems students with rich experiences in nature could more easily transfer knowledge from one learning situation to another. Several articles support the specific connection between experiences in nature and science test scores. This project sought to add to the literature available on this topic.

Chapter 3

Methods and Procedures

Instrument Development

In a previous action research project on this topic, professors and graduate students collaborated in making an Awareness of Nature Scale (Mikles, Zink, & Zwakenberg, 2010). The researchers consulted with those same professors and graduate students on how to improve the original instrument. The original instrument consisted of three categories of questions concerning nature awareness: direct experiences in the natural world, indirect experiences in the natural world, and attitudes toward the natural world. The researchers modified the original instrument according to an article by Davis, Rea, and Waite (2006). These authors cite Kellert (2002) as describing three slightly different divisions of nature experiences. The categories of questions for this modified survey stem from this description. Kellert (2002), as cited in Davis, Rea, and Waite (2006), suggests individuals experience nature in three distinct ways: directly, indirectly, and vicariously. Direct experiences in nature often occur spontaneously in a natural environment. For instance, individuals who have been hiking in the woods experience the natural world up-close and personal. One of the direct experience questions on the survey asked, “Have you hiked in the woods?” Indirect experiences with nature, while still experienced first-hand, are planned and controlled by human interaction. Thus, a field trip to the zoo may be considered an indirect experience in nature because individuals view animals from a distance but may not touch them or even experience the animal’s natural environment. An indirect experience question on the survey asked, “Have you been to the zoo?” Vicarious experiences in nature offer second-hand experience with the natural world perhaps through a book, computer game, or television program (Davis, Rea, & Waite, 2006). A vicarious experience question on the survey asked, "Do you watch TV shows about real animals?" Therefore, the modified survey consisted of seven questions for each of these categories of nature experiences.

In assessing last year's research project on this topic, the researchers identified the attitudes category as the weakest section of the Awareness of Nature Scale. In an effort to create a more accurate and reliable instrument, the researchers redesigned the layout of the survey. Instead of including a specific section measuring attitudes, the researchers added an attitude component to each question. Piaget's theory of cognitive development provided the rationale for assessing both the attitude and the experience at the same time. Most fourth grade students are in the concrete operational stage of development. This suggests fourth grade students can only solve problems that apply to actual events and not abstract concepts (Ormrod, 2008). Thus, the researchers decided to ask students questions about an experience and then immediately gauge their attitude toward that experience. This provided a concrete connection between the experience and the attitude. The modification to the survey provided more accurate results concerning attitude toward nature experiences.

Instrumentation

The Nature Awareness Survey was administered by the researchers in four fourth grade classrooms. The researchers gave each student a hard copy of the Nature Awareness Survey and a pencil. The researchers read each question aloud to ensure every student read the questions correctly with comprehension. The survey consisted of 21 questions about experiences in nature: seven direct, seven indirect, and seven vicarious. For each of the 21 questions, students marked their answer by writing one check mark next to yes☺, or yes☹, or no. The yes☺ indicated the student had the experience, and it was a positive experience. The yes☹ indicated the student had the experience, but it was a negative experience. An answer of no indicated the student had not had the experience.

Before giving the survey to students in the four classrooms, the researchers implemented a pilot study with third and fourth grade students at an afterschool program in a local church. The students completed the survey in the exact manner the actual participants completed the survey. The researchers evaluated the success of this survey by monitoring student comprehension of the instructions, questions, and layout of the survey. After the Nature Awareness Survey was completed, the researchers obtained feedback from the third and fourth grade students. They considered the students' suggestions before finalizing the survey instrument. In addition, the researchers acquired qualitative data from elementary science teachers concerning the instrument. The teachers were asked to consider layout, content, wording, and age appropriateness of the Nature Awareness Survey. The teachers provided feedback on the ease of use and validity of the survey as well. The critique these teachers offered was considered and several suggestions were incorporated in the final construction of the instrument.

The researchers accounted for content validity by ensuring the material on the survey complemented the science curriculum. The researchers also used the third grade TCAP scores from each class to determine if the approximate science achievement level of the participating classes was somewhat equivalent. An independent sample T-test was used to compare the classes. The researchers also conducted a test-retest study in order to demonstrate the reliability of the instrument. The researchers determined the correlation between the test and retest for each class using the Pearson correlation and Spearman's rho. The acceptable correlation coefficient of .70 or above is what is used to establish an instrument as reliable. The researchers used the test with the most student responses from both classes in their analysis. The researchers also performed a split-half reliability test. This required an examination of the odd and even questions and answers to ensure the reliability of students' answers.

Participants

The participants in this study included fourth grade students from one urban and one suburban school. This study consisted of a convenience sample of classroom students. The researchers attained a sample size of 56. This required the participation of two fourth grade classes from both base schools. The parents of these students provided written permission for their children to participate in this study. The researchers chose to discard data collected on students with a modified TCAP score in order to remove an extra confounding factor. The researchers did not have adequate time, resources, or opportunity to address this additional factor.

Research Design

The survey research took place at one urban and one suburban school two times during the study. The survey was administered during the week of January 18-21, 2011, and then it was given again during the week of February 14-18, 2011. The answers on the nature survey represented the following number of points: yes & happy face= 2, yes & sad face=1, no=0. This indicated if a student had taken part in a certain nature experience and if his/her attitude toward that experience was positive or negative. Thus, “yes & happy face” meant the student had taken part in the nature experience, and it was a positive experience for the student. The total number of points for each student was added up by the researchers. A high number of points indicated a high awareness of the natural world and a low number of points indicated a low awareness of the natural world. The researchers collected the fourth grade students’ science grades during the nine week grading period of January 10-March 11, 2011. At the end of February, the researchers formulated an average science grade for each student.

Data Analysis

The total points from each student’s Nature Awareness Survey and each student’s average science grade provided the quantitative data to perform a statistical test using an Excel spreadsheet. The researchers applied a Pearson correlation and a Spearman’s rho to determine if a correlation between students’ nature awareness scores and their science grades exists.

Chapter 4

Results

Analysis of Data

The purpose of this study was to determine whether a correlation exists between students' experience in nature (as determined by a nature awareness score) and their science grades. The researchers conducted the study over a nine-week period in four fourth-grade classes at two schools. An independent sample T-test using the students' TCAP scores suggests average science TCAP scores at the first base school ($M = 757.56$, $SD = 27.09$) are somewhat equivalent to the average science TCAP scores at the second base school ($M = 750.48$, $SD = 43.08$). Therefore, the mean difference between the two schools was not significant, $t(54) = .71$, $p > .05$, $d = .48$.

The researchers sought to design a reliable instrument which could indicate a possible relationship between students' awareness of the natural world and their science grades. So, the researchers developed the Nature Awareness Survey which included seven questions for each of the following categories: direct experiences with nature, indirect experiences with nature, and vicarious experiences with nature. Each question also accounted for students' attitudes toward the nature experience. In order to demonstrate the consistency of the survey instrument, the researchers administered the survey as a test during the week of January 18-21 and as a retest during the week of February 14-18. The acceptable correlation coefficient of .70 or above is what is used to establish an instrument as reliable; thus, a Pearson Correlation and a Spearman's rho for the data revealed a significant test retest reliability between the two surveys, $r = +.83$, $n = 55$, $p < .01$, two tails.

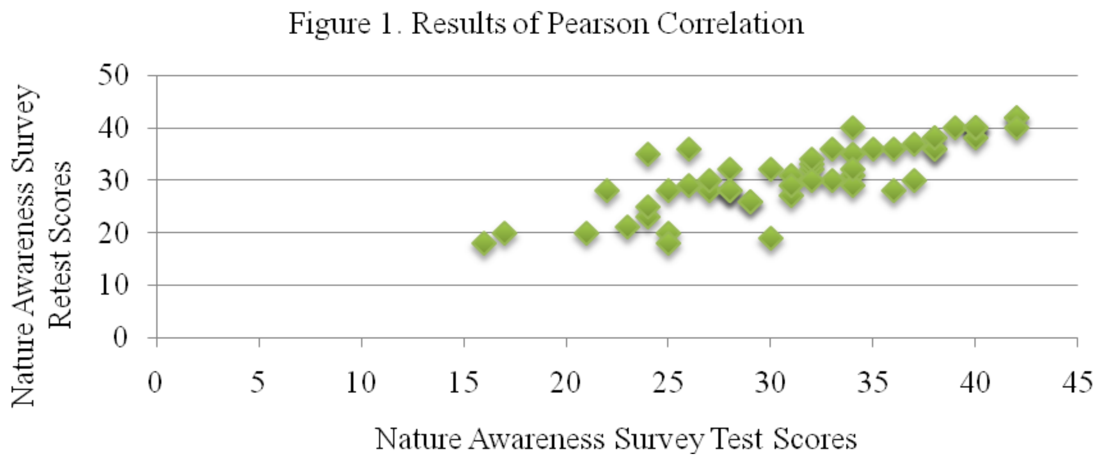

Figure 1. Applying a Pearson Correlation and a Spearman's rho to the Nature Awareness Survey test and retest data produced the results shown.

The Nature Awareness Survey was found to be reliable (21 items; α = .75). In order to further solidify the internal consistency reliability of the survey instrument, the researchers performed a split-half reliability test which involved identifying the correlation between the odd and even numbered questions on the survey. The results of both a Spearman-Brown and a Guttman Split-half test revealed significant internal consistency reliability for the Nature Awareness Survey, r = .79.

The researchers proposed the following hypothesis. H_1: Nature awareness scores are significantly correlated to science grades. The total score from each student's Nature Awareness Survey and each student's average science grade was entered into an excel spreadsheet. In order to determine if a relationship existed between students' experiences in nature and their science grades, the researchers applied a Pearson Correlation and a Spearman's rho to the recorded data. A correlation for the data revealed a student's awareness of the natural world and his/her science grades were significantly related, r = +.34, n = 56, p < .05, two tails. These findings led to the acceptance of the proposed hypothesis.

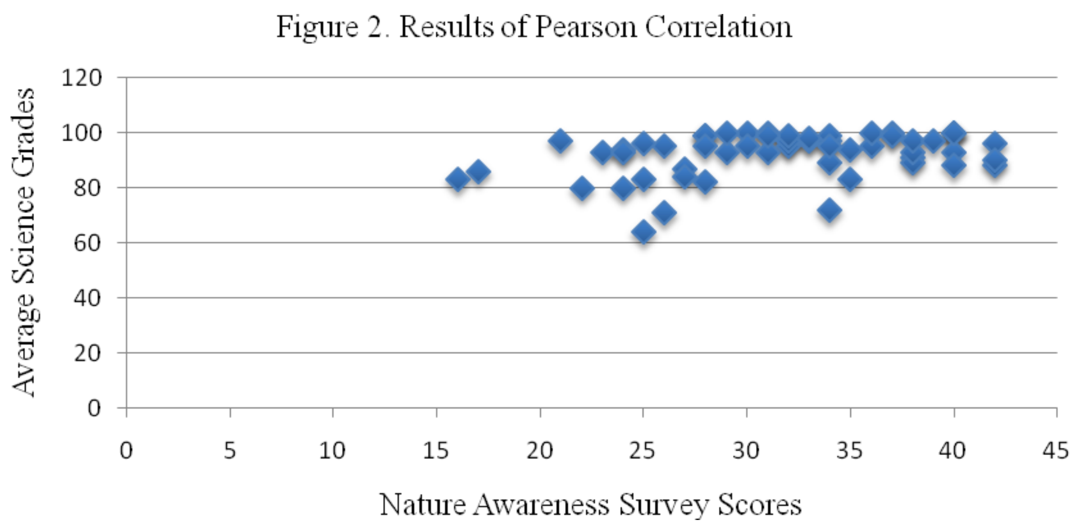

Figure 2. Correlation between nature awareness scores and science grades of fourth grade students.

Although it was not the focus of this study, researchers also found a significant relationship between nature awareness scores and science TCAP scores, $r = +.39$, $n = 54$, $p < .01$, two tails. Even though the researchers accepted the hypothesis that nature awareness scores are significantly correlated to science grades, the correlation between the Nature Awareness Survey scores and science TCAP scores provided a more significant correlation.

Chapter 5

Discussion

Summary

This study was designed to examine the relationship between nature awareness scores and students' science averages. Four fourth-grade classrooms in East Tennessee were used in this study. Two of these classrooms were at a school in a suburban setting, and two classrooms were at a school in an urban setting. The researchers obtained permission from the parents of 56 student participants. Thus, the sample size for this study was small and not random.

The researchers administered a test and a retest of the Nature Awareness Survey. This survey examined students' direct, indirect, and vicarious interactions with nature. In addition, this survey examined students' attitudes toward the nature experiences. The researchers assumed students would provide honest and thoughtful responses to the Nature Awareness Survey. After completing the survey, each student received a nature awareness score according to his/her responses to the 21 question Nature Awareness Survey. The researchers chose to use students' average science grades, and they assumed these grades would provide an accurate report of the students' science knowledge. The researchers analyzed the data using a Pearson Correlation. In assessing the results, the researchers found a significant relationship between students' nature awareness scores and their science grades. A significant correlation also existed between the students' nature awareness scores and their science TCAP scores.

Conclusions

This study should encourage teachers to capitalize on the three different categories of nature experiences when teaching science content. Examples of the three kinds of exposure to nature include field studies in creek beds (direct), field trips to the zoo (indirect), and use of nature movies in the classroom (vicarious). Educators should promote and facilitate direct, indirect, and vicarious student interactions with nature in order to foster backward-reaching high road transfer of science understanding. The researchers believe the students with higher nature awareness scores and higher science averages experience this type of transfer in the classroom. These students were able to draw from their experiences in nature and transfer that knowledge to classroom learning. Positive experiences in nature also seem to impact students' science averages and science TCAP scores. Furthermore, as students' nature awareness scores increase, there appears to be less variability in their science averages. These conclusions further support the significant relationship between the two components of this field study.

Additionally, this study provides a Nature Awareness Survey instrument which demonstrates substantial internal consistency reliability. The researchers changed last year's survey instrument in order to improve the reliability and validity. The scale used for this research project used a three value scale (2, 1, and 0). This scale assessed both experience and attitude in one measure which was a change from last year. According to the data, the nature awareness scale and questions provide a solid instrument which can possibly be used to test other correlations.

Recommendations

The researchers suggest further research be done with a larger population in order to gain additional evidence for accepting the proposed hypothesis. Moreover, the researchers suggest the survey be adjusted and used with a different age group of students. Studies have been completed with elementary age students, but it is recommended that other studies be completed with high school aged students. This would allow researchers to gain a better understanding of the relationship between nature awareness and science grades. Perhaps researchers could find a correlation between nature awareness scores and ACT scores. It may also be worthwhile to explore students' averages in other subject areas such as English or Math.

The researchers also recommend the use of a standardized test instead of science averages. The researchers observed that science grades often reflect a student's effort rather than a student's actual content knowledge. Furthermore, the researchers suggest research be done with students who have been labeled "resource." The data collected on two "resource" students was removed from this study in order to decrease the number of confounding variables. A sample size including only "resource" students would provide an interesting study, and the results could assist educators in providing more effective instruction for these students.

The researchers also advise more research on the possible correlation between students' nature awareness scores and parental involvement. The statistical data concerning the Nature Awareness Survey instrument suggests the internal reliability of the indirect experiences portion of the survey was significant. Therefore, a child's indirect experiences in nature may be the most influential to his/her nature awareness.

With this in mind, the researchers encourage future research to focus on who is responsible for children's indirect experiences in nature. The researchers wonder if the results would be correlated differently between teacher-led indirect experiences and parent/guardian-led indirect experiences. Additional research in many areas can supplement the significant results of this study.

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APPENDICES

APPENDIX A:

LETTER OF APPROVAL TO KNOX COUNTY SCHOOLS

KNOX COUNTY SCHOOLS
ANDREW JOHNSON BUILDING

Dr. James P. McIntyre, Jr., Superintendent

October 18, 2010

Dr. Chris Templar
Johnson Bible College
7900 Johnson Drive
Knoxville, TN 37998

Dr. Templar:

You are granted permission for your students to conduct their Action Research projects.

In all research studies names of individuals, groups, or schools may not appear in the text of the study unless specific permission has been granted through this office. The principal researcher is required to furnish this office with one copy of the completed research document.

Good luck with your studies. Do not hesitate to contact me at 865-594-1735 if you need further assistance or clarification of the research policies of Knox County Schools.

Yours truly,

John Beckett
Supervisor
Research and Evaluation

Project Number: 1011018

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APPENDIX B:

PARENTAL APPROVAL FORM

To Whom It May Concern:

We, Kelly Chandler and Monica Swartzentruber, request permission to use the results of your 4th grade student's responses in a Nature Awareness Survey. This survey will be distributed during science class once in January and once in February. This survey consists of yes or no questions about nature experiences. Your student's grades will not be affected by his/her responses of the survey. This survey is merely a tool to acquire data about 4th grade students' awareness of nature. We also would like your permission to use your students' science grades as part of our research. Your students name will not be included anywhere in this project, and we ensure the privacy of your students' survey results also.

If you agree to let us use the results of this survey, as completed by your student, please fill out the slip at the bottom of this letter. Cut along the dotted lines, and return the slip to your student's homeroom teacher by November 19th. If your child does not bring back this slip, he/she will not be allowed to participate in our study. We appreciate your participation.

Sincerely,

Kelly Chandler & Monica Swartzentruber

Johnson Bible College Graduate Students

I give (student's name) ________________________________ permission to participate in the Nature Awareness research study.

Signature__________________________________Date__________________________

APPENDIX C:

SAMPLE SURVEY

Nature Awareness Survey

Name: ____

Please answer the questions by checking one of the boxes.

1. Have you hiked in the woods?	___yes ☺	___yes ☹	___no
2. Have you ever had a pet in your home?	___yes ☺	___yes ☹	___no
3. Have you walked in a stream?	___yes ☺	___yes ☹	___no
4. Have you looked at the stars at night?	___yes ☺	___yes ☹	___no
5. Have you caught fireflies?	___yes ☺	___yes ☹	___no
6. Have you ever climbed a tree?	___yes ☺	___yes ☹	___no
7. Have you ever built a snowman?	___yes ☺	___yes ☹	___no

8. Has your family ever had a vegetable garden?	___yes ☺	___yes ☹	___no
9. Has your dog had puppies (or cat/kittens)?	___yes ☺	___yes ☹	___no
10. Have you ever been to a zoo?	___yes ☺	___yes ☹	___no
11. Are there flower gardens around where you live?	___yes ☺	___yes ☹	___no

12. Have you visited a nature center (IJAMS Nature Center, Tennessee Aquarium)?	___yes ☺	___yes ☹	___no
13. Have you ever listened to the sounds bugs make at night?	___yes ☺	___yes ☹	___no
14. Has there ever been a pet in your school classroom?	___yes ☺	___yes ☹	___no
15. Have you ever read/watched the Magic School Bus Series?	___yes ☺	___yes ☹	___no
16. Do you/did you own a Webkinz/Giga pet?	___yes ☺	___yes ☹	___no
17. Have you ever watched a weather show/movie?	___yes ☺	___yes ☹	___no
18. Have you ever watched TV shows about real animals?	___yes ☺	___yes ☹	___no
19. Have you ever read about dinosaurs?	___yes ☺	___yes ☹	___no
20. Have you ever had photographs of animals in your house?	___yes ☺	___yes ☹	___no
21. Have you ever read books in your home about real animals?	___yes ☺	___yes ☹	___no