THE DEVELOPMENT AND EVALUATION OF A FORESTRY EDUCATION UNIT TAUGHT BY TRAINED ENVIRONMENTAL EDUCATORS FOR SELECTED FIFTH GRADE CLASSROOMS IN CENTRAL WISCONSIN

by

Michael J. Kerkman

A thesis submitted in partial fulfillment of the requirements of the degree

MASTER OF SCIENCE

IN

NATURAL RESOURCES (EMPHASIS: ENVIRONMENTAL EDUCATION)

College of Natural Resources

UNIVERSITY OF WISCONSIN--STEVEN'S POINT

Stevens Point, Wisconsin

May 2003
APPROVED BY THE GRADUATE COMMITTEE OF:

Dr. Daniel J. Sivek
Professor of Environmental Education

Dr. Dennis H. Yackers
Associated Professor of Environmental Education

Dr. Lyle E. Nauman
Wildlife Biology Professor Emeritus
ABSTRACT

Though Wisconsin has many programs and practices that make it a state leader in environmental education (EE) in the United States, recent studies reveal that a high percentage of K-12 teachers in Wisconsin are still unprepared to meet state EE mandates. In order to increase the amount and effectiveness of EE instruction in Wisconsin, this project developed a three-lesson environmental education unit (entitled Project FOR.E.S.T.) from existing EE resources, which was taught by trained instructors to fifth grade classrooms in three Wisconsin counties. The unit consisted of forestry-related lessons. Forestry is the second biggest industry in the state of Wisconsin, and research in the field has highlighted the importance of locally-focused EE. The effectiveness of the forestry EE unit was assessed with a pre- and posttest of knowledge and attitudes administered to control and experimental groups of fifth grade students. Fifth grade teachers were also surveyed to assess their perceptions of the effectiveness of the unit and their willingness to incorporate it into their classroom curriculum. Results from the project show increases in student knowledge and attitudes in regards to forestry issues as a result of unit instruction. Results also support the use of short, locally focused, in-service teacher education as an effective method of increasing the use of EE resources. Results from this study can be used to strengthen the effectiveness EE material development and dissemination.
ACKNOWLEDGEMENTS

This has been a fascinating, fun, and educational project, and I am fortunate to have been chosen to work on it. I would like to begin by thanking Dr. Dan Sivek, Dr. Lyle Nauman, and Bill Ebert and Golden Sands R C & D for conceptualizing the project and authoring the grant that provided funding. They, along with Dr. Dennis Yockers, also provided the guidance and support that helped me bring the project to fruition. Thank you also to the Wisconsin Environmental Education Board for providing the main funding for the project. Appreciation and gratitude goes to the teachers (including the participants!) and professors who helped me in the many, many review processes necessary for this project.

The past two years have provided opportunities and experiences in and out of the classroom that have been extremely valuable to me. I would like to thank the UW-SP Environmental Education and Interpretation Program, the UW-SP professors, and the staff of the WCEE for such a great education! I have received invaluable preparation for my entry into the field of environmental education.

Many others have given me support in very individual and special ways: my family, especially Mom, Dad, and Nana; the great friends here in Point and from all around: you are important family to me too; and also in particular Stephanie Kane, Bill Thomas, and Tres and Michael Fromme-Carey, who have given me indescribably important support, advice, and friendship. Thank you to all of you.

Finally, to Dr. Peggy Pollak and Dr. Lynn Montgomery: you have helped me in so many ways. For your encouragement, friendship, and confidence in me I really can’t thank you enough. I hope you know how much of a difference you have made.
TABLE OF CONTENTS

ABSTRACT.............................................................................. iii

ACKNOWLEDGEMENTS............................................................ iv

CHAPTER ONE-THE PROBLEM AND ITS SETTING
Importance of the Study................................................................. 1
Statement of the Problem............................................................... 2
Subproblems.............................................................................. 3
Delimitations.............................................................................. 3
Definition of Terms...................................................................... 4
Assumptions.............................................................................. 5

CHAPTER TWO-REVIEW OF RELATED LITERATURE
The Condition of, and Need for, Environmental Education in Wisconsin....... 6
Increasing the Success of Environmental Education....................... 8
Summary.................................................................................. 11
Forestry Education....................................................................... 11
Evaluating the Effectiveness of an EE Program................................ 14
Increasing Environmental Knowledge and Attitudes with EE......... 15
Evaluating EE Programs....................................................... 16
   Models of Evaluation: Cognitive Domain.......................... 16
   Models of Evaluation: Affective Domain........................... 18
Summary.................................................................................. 19

CHAPTER THREE-RESEARCH PROCEDURES
Funding and Project Scope............................................................. 20
Unit Development and Implementation........................................... 23
Test Item Development................................................................ 28
Administration of the Pre- and Posttest............................................ .... 31
Teacher Surveys......................................................................... 37

CHAPTER FOUR-RESULTS
Subproblem One.......................................................................... 40
Subproblem Two......................................................................... 41
   Changes in Student Knowledge of Forests and Forestry........... 42
   Changes in Student Attitudes about Forests and Forestry........ 44
Subproblem Three........................................................................ 45

CHAPTER FIVE-SUMMARY, INTERPRETATIONS, CONCLUSIONS, AND
RECOMMENDATIONS
Summary.................................................................................. 56
Gains in Student Knowledge of Forests and Forestry....................... 56
Gains in Student Attitudes About Forests and Forestry................... 57
CHAPTER ONE-THE PROBLEM AND ITS SETTING

IMPORTANCE OF THE STUDY

Though Environmental Education (EE) is a relatively new field (its goals and objectives conceptualized with the Tblisi Declaration of 1977), the State of Wisconsin already has a history of leading the development and implementation of EE programming in schools. In 1985, Wisconsin became one of the first states to require EE preparation and training for teachers seeking certification. At present, environmental education is a required component of school curricula. Yet several studies show that even in a state in which EE is required, mandates are not being met. Many teachers (77% in 1995) graduated before the 1985 certification changes (Champeau, 1997). Even after certification changes went into effect, less than half the teachers in a 1993 study reported receiving EE pre-service education, despite having graduated in or after 1985 (Lane, 1993). The same research has also indicated that only one third of Wisconsin teachers in the disciplines mandated to implement EE plans reported that their districts have done so (Lane, 1993).

An array of EE curricula and activity guides are available to teachers (for example Project Learning Tree, Project WILD, Project WET), but often attending a workshop is a pre-requisite to receiving the materials, and funding and time concerns may be a detriment to completion of such workshops. Coupled with this, research has shown that participation in pre-service and in-service teacher education in EE is
characteristic of teachers with pre-existing, positive perceptions of their EE teaching competencies (Lane, 1993). In Wisconsin, many school districts (23-40%) do not themselves offer any environmental education in-service, workshops, or courses (Champeau, 1997).

The study discussed here aimed to increase EE instruction in Wisconsin. A forestry education unit developed from pre-existing EE resources was used to increase EE interest and instruction for teachers who may not otherwise use (or even encounter) the resources. All public school, fifth grade teachers in four Wisconsin counties were provided the opportunity to learn the subject matter while a trained environmental educator taught the lessons to students.

The environmental education unit used in this study focused on forestry and forests due to their importance as an industry and natural resource in the state of Wisconsin.

STATEMENT OF THE PROBLEM

The purpose of this study was to develop and evaluate the use of a fifth grade forestry education unit taught by trained environmental educators as a tool to improve environmental education in four Wisconsin counties.
SUBPROBLEMS

1. To develop a multi-disciplinary, fifth grade, 3-lesson forestry education unit that could be incorporated into individual teachers’ curricula after instruction by trained environmental educators.

2. To measure the unit’s effectiveness using a pre- and post-unit test of fifth graders’ knowledge and attitudes in regards to selected forestry topics and issues.

3. To evaluate, with a post-unit teacher survey, opinions on unit appropriateness and effectiveness, teacher willingness to incorporate forest and forestry education into classroom curricula, and the value of in-service training in forest and forestry education.

DELIMITATIONS

1. Only public, fifth grade classrooms in the Wisconsin counties of Marathon, Marquette, Waupaca, and Portage were included in the study. The study used a sample of convenience of any fifth grade teacher from within these counties that agrees to participate.

2. No comparison between individual students or groups of students (based on gender, etc.) was made.
3. No comparison was made between teachers, schools, districts or counties.

4. Lessons, tests, and surveys only dealt with forest and forestry-related concepts and issues.

DEFINITION OF TERMS

**Classroom Assistant (CA):** a trained specialist in instruction of the 3-lesson forestry unit developed for this project.

**Environmental Education:** a field that is “aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution” (William B. Stapp, et. al. as quoted in Hungerford, et. al., 1998).

**Forestry:** the principles and practices utilized in the management, use, and enjoyment of forests (American Forest Foundation, 1993).

**Project FOR.E.S.T.:** The title given to the three lesson forestry education unit developed and instructed for this project. FOR.E.S.T. refers to FORestry Education for Students and Teachers.

**Reliability:** the degree of accuracy of the measuring instrument (adapted from Leedy, 1993).

**Renewable resource:** resource that can be replenished fairly rapidly (hours to several decades) through natural processes (Miller, 2003).
Sustainable Forestry: the practice of managing dynamic forest ecosystems to provide ecological, economic, social, and cultural benefits for present and future generations (Wisconsin Department of Natural Resources, 1996).

Validity: the degree of effectiveness and soundness of the measuring instrument (adapted from Leedy, 1993).

Unit: the complete set of activities, materials, lesson plans, goals and objectives upon which instruction will be based. The Classroom Assistant taught the unit as 3 lessons, though the unit provided to teachers consisted of two additional lessons to provide for expansion if so desired.

ASSUMPTIONS

1. The staff of Classroom Assistants, upon completion of the training sessions, was effective and consistent in their instruction of the unit.

2. Changes in student knowledge and attitude can effectively be assessed by a multiple-choice survey or test.

3. The selected test review panel(s) consists of experts in their respective fields, who are effective in their evaluation of validity.
CHAPTER 2-REVIEW OF RELATED LITERATURE

This review of literature is organized as follows:

1. The Condition of, and Need for, Environmental Education in Wisconsin
   a. Increasing the Success of Environmental Education

2. Forestry Education

3. Evaluating the Effectiveness of an EE Program: Changes in Student Knowledge and Attitudes
   a. Increasing Environmental Knowledge and Attitudes with EE
   b. Evaluating EE Programs
      i. Models of Evaluation: Cognitive Domain
      ii. Models of Evaluation: Affective Domain

THE CONDITION OF, AND NEED FOR, ENVIRONMENTAL EDUCATION IN WISCONSIN

The Ninth Annual Roper Poll Report Card on Environmental Attitudes, Knowledge, and Behaviors in the United States (Roper Starch Worldwide, 2001) reveals that though Americans largely favor education about the environment, their own basic environmental knowledge is lacking. An astounding 95% of Americans feel that environmental education should be taught in K-12 schools, while 86% feel that
the government should be involved in supporting adult environmental education programs. In contrast to the highly positive results about American’s attitudes regarding EE, American environmental knowledge is worrisome. Using a 12-question “quiz” of basic environmental knowledge, the Roper poll found that only one in ten adults in the US could achieve an “A” (answering at least 11 questions correctly), while 55% of respondents received a failing grade on the quiz (Roper Starch Worldwide, 2001). A severe dichotomy seems to exist between intentions for environmental education and the actual education Americans are receiving about environmental issues and concerns.

As a state, Wisconsin mirrors many of the trends found in the 1999 report. First, Wisconsin educational policy strongly favors education about the environment. Wisconsin’s dedication is evident in the statewide mandates to support EE implementation. The state Department of Public Instruction (DPI) Administrative Code PI 3.05(4) requires that pre-service teachers receive EE training before licensure (Engleson and Yockers, 1994). In addition, Administrative Code PI 8.01(2)(k) requires every school district to develop and implement a “written, sequential curriculum plan incorporating instruction in environmental education into all subject area curriculum plans” (Engleson and Yockers, 1994).

Yet many of Wisconsin’s teachers also mirror the country’s lack of sufficient EE knowledge. A state-specific study of Wisconsin teachers’ perceived competencies in teaching EE revealed that one of the most common reasons for not infusing EE into existing curriculum was “lack of background” in Environmental Education (Lane,
Furthermore, these teachers reported spending less than one-half hour per week per subject teaching about the environment (Lane, 1993).

The developing dichotomy in Wisconsin is that though we have declared the importance and validity of EE on a state level, the actual instruction of EE at the classroom level is inadequate to accomplish this goal. This may be due to the fact that a large percentage (77% in 1997) of Wisconsin teachers graduated before mandates took effect. Yet it is also noted that despite state-mandates for EE curriculum development and implementation, many districts still have not implemented EE plans (Lane et al., 1996).

Increasing the Success of Environmental Education

The suggestions in much of the available literature point towards increasing teacher training in order to increase EE success (Lane, 1993; Lane et al, 1995, 1996; Krantz, 2001; Oonyu, 1998; Wilke, 1979). Implementation of EE can be realized “only…when one’s competence and confidence levels in integrating environmental concerns and concepts to the discipline one teaches are raised” (Oonyu, 1998). Mandates in Wisconsin require that pre-service teachers experience coursework exposure to EE, but as has been discussed, this alone does not seem to be effective. One way to begin increasing EE awareness and implementation is to focus on training working classroom teachers by providing EE training to more than pre-service teachers. Lane (1993) reports that the amount of time teachers spend teaching about
the environment “increases in a positive relationship with the number of in-service EE courses they have taken,” and goes on to recommend that “opportunities for teachers to take in-service courses in EE should be made available and teachers should be encouraged to take advantage of these opportunities” (Lane, 1993). The Wisconsin Department of Natural Resources (WDNR) has made similar recommendations. In a 2001 report on school forest use in Wisconsin, the WDNR states, “Curriculum development and teacher training for school forestry should be improved throughout the state” (Krantz, 2001). These recommendations are also supported by Oonyu’s study of Ugandan schools (1998), as he urges environmental educators to rely not solely on pre-service training, but to implement “short in-service courses for trained and untrained teachers tailored towards giving the teachers a sound background in environmental concerns and issues… and instructional strategies and approaches, and providing them with materials to use” (Oonyu, 1998). Finally, Wilke (1979) suggests that resource use by teachers increases when resources are distributed in association with workshop participation, as opposed to distribution alone.

In planning teacher in-service training, it is necessary to work with teachers and children in schools on “suitably small-scale activities” (Oulton and Scott, 1995 as quoted in Grace, 2000). In Wisconsin, this may mean using new strategies. A 1989 study reported that over 12,000 teachers in Wisconsin had participated in workshops such as Project WILD and Project Learning Tree (Cooper, 1989 as quoted in Lane et al., 1995). Yet it may be that these voluntary workshops attract mostly those teachers
with pre-existing interests in the field of EE. Instead it may be beneficial to focus on bringing the training to the classroom for “short in-service courses” (Oonyu, 1998).

Effectiveness also increases for teachers and students when EE focuses on the local level. Grace (2000) identifies rhetoric-reality gaps in environmental education, citing evidence of mismatches between “advocated views of theorists and teaching realities in schools”. His study suggests that this gap can be bridged in part by encouraging teacher interest and participation through more focus on local environmental issues. Local environmental issue involvement is in fact cited in the Grace study as one of the top-ranking factors in eliminating the rhetoric-reality gap.

Current EE theory is encompassing these ideas in discussion of place-based education, or fostering a “sense of place.” In focusing primarily on global environmental issues, educators may actually instill in their students feelings and ideas that are contrary to the goals of EE. If students do not have a sense of their own efficacy and an emotional connectedness to their own environment, “lay[ing] the weight of the world’s ecological problems on elementary students...[creates] a condition of fear and disempowerment called ‘ecophobia’” (Sobel, 1997). Yet in exploring first their own community and environment, children develop relationships to the natural world that can be nurtured into an empathy for the global environment. The skills they learn are applicable elsewhere, “the place that one inhabits can teach about the interdependency of social and natural systems” (Arenas, 1999). By first focusing on the goals of EE locally, the goals can later be extended to empathy with other environments. Indeed “studying about and acting on the locality is a vital means
for understanding the importance of collective solutions [and] contextualizing academic education in meaningful situations” (Arenas, 1999).

In Wisconsin, 46% of the land is forested (Wisconsin Department of Natural Resources, 2003) and the forest industry is the second largest industry in the state. In focusing on local, small scale, in-service teacher training, it is appropriate to begin with education about these forests. The value of forestry education will be discussed in the next section of this chapter.

Summary

The published literature indicates that Wisconsin EE suffers from what has been called a rhetoric-reality gap: the desire for environmental education is there, the fulfillment, in many instances, is not. In order to remedy the situation, EE should concentrate on teacher training that is in-class, locally-focused, and small-scale. This can be brought about through in-service forestry education.

FORESTRY EDUCATION

At the time of this writing, the human population of the world numbers well over six billion. Stabilizing population growth is an important necessity, but we must meanwhile ensure that the world’s increasingly valuable natural resources are used wisely. Sustainable use of renewable natural resources is imperative. Current
populations need to responsibly manage renewable resources--our air, soil, water, crops, and forests--to provide for current needs while ensuring that future generations will have equal or improved resources for their needs. Our forests are an important renewable resource for which sustainable use must be the goal. “The challenge for future generations is to ensure continual production of quality forests” (Markham, 2000). Inherent in the field of EE is the belief that education can bring about these changes.

Education about sustainable resource use is a necessary component of environmental education, and (as previously discussed) focusing on issues of local importance increases EE effectiveness. Denenny (2000) quotes one instructor who urges educators to teach students about the natural resources in the forests around them:

“It behooves us as educators to reveal [the natural resources in the community] and to make the greatest use of them. Our students will not grow up blindly in the middle of a forest” (Denenny, 2000).

Wisconsin’s economy is based heavily on its forests; the forest industry is the second largest industry in the state. As forests are part of what defines Wisconsin economically and culturally, education about wise use of this renewable natural resource is necessary. Forestry education can foster “an appreciation for and an awareness of the impact of the growing human population on forests” (Markham, 2000) and teach students “applied science skills for today’s global issues” (Denenny, 2000).
As with environmental education as a whole, forestry units are multidisciplinary. A forestry lesson can be incorporated into many subjects and at all grade levels. Discussing forest management issues allows teachers to incorporate “plant classification, reproductive strategies of plants, dichotomous keys, and practical applications of mathematics, social studies, and writing skills [as well as]... social issues, such as aesthetics and recreation; biological issues, such as water quality and biodiversity; and economics, which deals with supply and demand” (Markham, 2000).

Forestry education is already being incorporated into lesson plans and activities in select national and local EE publications. These activity guides aim to make the connections to the importance of wise-use of forest resources for a variety of classrooms. Project Learning Tree is a K-12 activity guide published by the American Forest Foundation and consists of 96 forestry or related-issue lessons. The publication is made available to teachers who attend regional training workshops. Wisconsin Forestore, geared toward middle school grades, is also available to teachers through training workshops or can be ordered through the Central Wisconsin Environmental Station. Wisconsin Forests Forever, published by Wisconsin Forest Resource Education Alliance (WFREA), is an elementary level activity guide made available to teachers through workshops and through direct purchase from WFREA. Another major Wisconsin activity guide is Wisconsin’s Millennium Tree, which was sent to all Wisconsin public school fourth grade teachers in 1999, and is now available online through the Wisconsin Department of Natural Resources (DNR), who published it as well.
EVALUATING THE EFFECTIVENESS OF AN EE PROGRAM: CHANGES IN STUDENT KNOWLEDGE AND ATTITUDES

Environmental Education aims to create “a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution” (Stapp, 1969 as quoted in Hungerford, et. al., 1998). Two of the accepted objectives of Environmental Education are 1) to increase environmental knowledge and 2) to instill an environmental ethic and value system based on this knowledge. These two objectives are necessary in helping to build responsible environmental conduct.

According to the Tblisi Declaration:

“...[E]nvironmental education should provide the necessary knowledge for interpretation of the complex phenomena that shape the environment, encourage those ethical, economic, and esthetic values which, constituting the basis of self-discipline, will further the development of conduct compatible with the preservation and improvement of the environment” (Hungerford, et. al., 1998).

At the fifth grade level, however, knowledge and ethic building should be a major emphasis (Engleson and Yockers, 1994).

There is a wide range of published studies that evaluate knowledge and attitudes. Some use such evaluations to assess the effectiveness of particular programming (Jaus, 1982; Pomerantz, 1986), while others focus on assessing knowledge and attitudes to reveal characteristics of a given population (Quale, 1993; Hsu and Roth, 1996; Paraskevopoulos, et. al., 1998). As discussed in the following
sections, the studies provide not only justification for working towards increasing knowledge and attitudes, but provide models for evaluation of the programs that intend to do so.

Increasing Environmental Knowledge and Attitudes with EE

Two important studies conducted in the 1980’s strongly support the use of EE in the classroom to affect children’s attitudes towards the environment as well as to improve children’s knowledge of the biophysical aspects of the environment.

Jaus (1982) used a 10-hour EE program for fifth graders to study the effect it had on changing their attitudes towards the environment. The instruction consisted of 15 lessons in environmental topics presented to a fifth grade classroom and evaluated with a post-instruction test. The posttest was also given to a control group. The findings of the study show that the EE instruction provided to the fifth graders resulted in more positive environmental attitudes than that of their counterparts in control groups.

Pomerantz (1986) also studied the effects of fifth grade environmental education. Her study focused on a program’s ability to increase children’s knowledge base. The study utilized Ranger Rick magazines as a tool to increase environmental knowledge. Children in the experimental groups were given three issues of Ranger Rick over a three-month period. Students were free to read the magazines in class or take them home, but no formal instruction was given in conjunction with issuing the
magazines. Evaluation of increases in knowledge was conducted by pre-/posttests of control and experimental groups. Combining the results of the study with previous findings, Pomerantz suggested the magazine had a very strong influence on children’s knowledge in a variety of natural resource areas.

Evaluating EE Programs

If one desires to provide justification of an environmental education program based on demonstrating that the program has effectively increased environmental knowledge and attitudes (such as in the above studies), a proper procedure to test for these factors must be established. A review of published knowledge/attitude tests reveals a variety of methods to do so.

Models of Evaluation: Cognitive Domain.

An introduction to a variety of testing techniques in the cognitive domain can be found in Hopkins and Stanley (1981). The two main classes of knowledge-based testing cited are fixed-response and short answer.

Within the fixed-response tests, multiple-choice, true/false, and matching items are reviewed. Multiple-choice is cited as having the strengths of requiring the “examinee to discriminate among alternatives” while “remov(ing) ambiguity and subjectivity in scoring”. Effective multiple-choice questions, though, can prove difficult to write. True/false items, conversely, may be easier to construct but less
reliable and valid than multiple-choice. True/false tests, however, may also allow students to complete “50% or more items in the same amount of testing time” (Frisbie, 1974 as quoted in Hopkins and Stanley, 1981). Lastly, matching exercises are considered useful and easy to score, but difficult to use when testing “higher-taxonomy-level skills such as the ability to interpret complex relationships”.

Short answer tests are generally considered more effective in assessing true student knowledge and at eliminating guessing. The trade-off, though, is that short answer tests are very difficult to grade objectively, and are far more time-consuming to score. Because of this, short answer tests are usually rejected for use in large-scale studies.

In reviewing research within the EE field, a variety of the above testing techniques are encountered, and often the techniques may be combined. Paraskevopoulos, et. al. (1998) assessed the environmental knowledge of 686 school students in Greece using multiple-choice and open-ended short answer questions. Pomerantz combined multiple-choice questions with true/false (1986), while Hsu and Roth (1996) opted to use strictly multiple-choice in their assessment of environmental knowledge of community leaders in Taiwan. Quale (1993) focused research strictly on the development of an effective environmental literacy assessment instrument at the fifth grade level, and the multiple-choice format was decided on for use in testing within the cognitive domain.
Based on consideration of similar studies and published evaluations of various testing strategies, it was decided to use the multiple-choice format to assess the knowledge of the students in the current study.

**Modes of Evaluation: Affective Domain.**

A fundamental difference in the nature of an affective question versus a cognitive question is in the nature of the "correct" answer. "The correct answer to an affective question depends on the person queried; the correct answer to a cognitive question is the same for all respondents" (Hopkins and Stanley, 1981). For affective assessment, attitude scales are usually favored over self-reporting, and specifically, a Likert-style test system is commonly employed (Hsu and Roth, 1996; Jaus, 1982; Ramsey and Rickson, 1976; Riblet, 1972).

The Likert scale provides a statement followed by a response continuum, usually "strongly agree, agree, undecided, disagree, strongly disagree", from which the respondent chooses the answer that most closely represents his/her feelings (Hopkins and Stanley, 1981). Many variations are made on the Likert model, such as removal of the neutral response to discourage it's over use (Riblet, 1972), and re-phrasing of statements to less-personal alternatives in the hopes of creating a more subtle and valid index of attitudes (Jaus, 1982). Again, in creating a specific 5th grade environmental literacy assessment tool, Quale (1993) opted to use a Likert-style testing instrument.
SUMMARY

Assessing the effectiveness of EE programs is commonly conducted through evaluation of changes in student knowledge and attitude. Pre- and post-unit evaluations often use multiple-choice questioning for questions in the cognitive domain, and Likert-style statements for the affective domain.
CHAPTER THREE-RESEARCH PROCEDURES

STATEMENT OF THE PROBLEM

The purpose of this study was to develop and evaluate the use of a fifth grade forestry education unit taught by trained environmental educators as a tool to improve environmental education in four Wisconsin counties.

SUBPROBLEM 1: TO DEVELOP A MULTI-DISCIPLINARY, FIFTH GRADE, 3-LESSON FORESTRY EDUCATION UNIT THAT COULD BE INCORPORATED INTO INDIVIDUAL TEACHERS’ CURRICULA AFTER INSTRUCTION BY TRAINED ENVIRONMENTAL EDUCATORS

FUNDING AND PROJECT SCOPE

Golden Sands Resource Conservation and Development Council, an independent, non-profit organization serving Central Wisconsin, funded the forestry environmental education project through their own support and a grant from the Wisconsin Environmental Education Board. Participating counties in Central Wisconsin (ultimately Portage, Marquette, Waupaca, and Marathon) provided matching funds. UW-SP professors Lyle Nauman and Daniel Sivek prepared the grant
proposal. The project was entitled Project FOR.E.S.T. (FORestry Education for Students and Teachers).

Originally, funding was provided by the grant to:

- Support the employment of a Graduate Assistant (GA) to conduct the project
- Support the employment of at least 6 undergraduate Classroom Assistants (CAs) to help with the in-class instruction of the unit
- Provide instruction for a minimum of 50 teachers and over 5,000 of their students in grades four through six.
- Provide instruction for all interested fourth through sixth grade classrooms in public schools in the counties of Portage, Marquette, Marathon, and Waupaca.

Early assessments by the graduate committee (Dr. Daniel Sivek, Professor of Environmental Education; Dr. Dennis Yockers, Associate Professor of Environmental Education; and Dr. Lyle Nauman, Emeritus Professor of Wildlife Biology) suggested that the scope of the project was too broad. The committee felt that given the schedules of undergraduate work-study Classroom Assistants, and the time necessary for instruction, it was unlikely the project would be completed successfully. The differences that exist between fourth and sixth grade would have also necessitated the development of two or three separate units. Based on conversations with the graduate committee, Sterling Strathe (project director of Wisconsin Forestree and Director of Wisconsin K-12 Forestry Education Program), Bill Ebert (Golden Sands Resource Conservation and Development Council), and Rachel Golden (graduate student working on a fourth grade forest history unit) it was decided to focus solely on fifth
grades. Department of Public Instruction teaching requirements regarding Wisconsin history at the fourth grade level provided an incentive to teach about forest heritage at that level (see also The Development and Assessment of "The Changing of the Land: A Wisconsin Forest History Unit, Masters Thesis by Rachel Golden). A new comprehensive forestry curriculum, Wisconsin Forestree, would increase instruction at the middle school level. Therefore, it was decided that it would be beneficial for this project to aim to increase the instruction of forestry environmental education at the fifth grade level. The addition of a fifth grade forestry unit would potentially work in combination with other programs to provide the opportunity for schools to build a holistic upper-elementary forestry education experience.

Teachers may find it difficult to incorporate new lessons into pre-existing curricula. They may be reluctant or unable to dedicate large amounts of class time to instruction of a unit not originally included as part of their individual curricula. Project FOR.E.S.T. was therefore limited to three lessons, to be taught consecutively (or within one week’s time) in 50-minute periods.

Finally, based on the previous research discussed in Chapter Two, Project FOR.E.S.T. was created to be an in-service teacher education unit. As such, trained classroom assistants (see below) taught all 3 lessons to the fifth grade students while the classroom teacher was in attendance, observing the dynamics of instruction of the forestry education unit.
UNIT DEVELOPMENT AND IMPLEMENTATION

A conceptual framework for Project FOR.E.S.T was developed based on the grant proposal, but reflected changes to the scope of the project discussed above (Appendix A). The Graduate Assistant created the conceptual framework based on research in forestry and forest education and also based on conversations with the Graduate Committee. The Graduate Committee approved the final version of the conceptual framework. Goals and objectives for Project FOR.E.S.T. (Appendix B) were then developed based on the conceptual framework. The overall goal and the 20 objectives were written so that they completely addressed all items delineated in the conceptual framework. These goals and objectives were submitted to the Graduate Committee in draft forms until a consensus in wording and content was reached, at which point they were considered the final draft.

The researcher next conducted a comprehensive review of forestry environmental education resources in the summer of 2001. Environmental education curricula and activity guides located in the Wisconsin Center for Environmental Education Resource Library were individually assessed for relevance and usefulness to the project based on the Project FOR.E.S.T. goals and objectives. Additional resources suggested in a University of Wisconsin—Stevens Point summer course, “Forestry Education Resources” were also assessed. Particular attention was given in the resource review process to Project Learning Tree, Wisconsin Forest Forever,
Wisconsin Millennium Tree, Wisconsin Forestree, and the School Forest Manual as the grant funding this project specifically cited those resources for consideration.

Activities were selected from the available resources and curricula based on

- Age-appropriateness (fifth grade level).
- Ability to be instructed within 50 minutes
- Relevance to Project FOR.E.S.T. goals and objectives
- Perceived fit to Wisconsin state standards for science, social studies, and environmental education.

The list of suggested activities was submitted to the Graduate Committee for review. The researcher and committee then selected specific activities to be combined into the three lessons. The activities selected were “Picture the Forest” from Wisconsin Forests Forever; “Build a Tree” from Sharing Nature with Children II; and “Tree Treasures” and “Tree Factory” from Project Learning Tree. These lessons were edited (when deemed necessary) for time, additional content needs, and ease of instruction. The lessons were then compiled into a cohesive forestry education unit and transcribed into lesson plans that highlighted the relevant objectives, materials needed, procedure, and evaluation opportunities for each lesson.

Two additional lessons were selected, edited, and added to the existing three. Whereas the original three lessons were those instructed to all classes and stand alone as an introductory forestry unit, the final two were added to the unit as a resource for teachers who may wish to expand the unit in future instruction, incorporating a more
complete forest unit into their curriculum. These final two lessons ("How Big is Your Tree" and "Trees for Many Reasons") were taken from Project Learning Tree.

The complete lesson plans (five days of lessons) were submitted for editing and review to three working fifth grade teachers in Wisconsin, Jon Albee, Jennifer McDermot and Timothy McCarthy. These fifth grade teachers also had the additional qualification of having received, or being in the process of obtaining, Masters degrees in Environmental Education from the University of Wisconsin--Stevens Point. The suggested guidelines for review by the teachers can be found in the letter in Appendix C. The teachers' comments were incorporated into revisions of the unit, and this revised draft was again submitted to the teachers for comments and review. At this point the lesson plans were submitted to the graduate committee for review based on the same guidelines suggested to the teachers, as well as final review for fit to project goals and objectives. The lessons were revised based on their comments until a final version was approved (Appendix D).

The activities were correlated to Wisconsin state standards for science, social studies, and environmental education at the fifth through eighth grade level with the assistance of fifth grade teachers Jennifer McDermot, Jon Albee, and Tim McCarthy as well as Dr. Dennis Yockers and Dr. Daniel Sivek. The correlations were identified using specially developed forms given to the teachers and professors (Appendix E). The forms were based on those created by Ginny Carlton for Wisconsin Environmental Education Board activities. The reviewers ranked each standard as being fully, partially, or not addressed by each of the three lessons that were part of
the instructed version of Project FOR.E.S.T. Agreement by three of the five reviewers
and the Graduate Assistant that a standard was “fully or partially” met by an activity
was the criterion for inclusion of a standard in the final version of Project FOR.E.S.T.

Funding for the project originally provided for up to six undergraduate
Classroom Assistants to aid in instruction of the unit. Re-analysis of funding and
instruction needs led to the decision to hire two Classroom Assistants (CAs). The CA
positions were advertised to UW-SP undergraduate students with junior- or senior-
level Elementary or Environmental Education major or minors. CAs were selected and
hired by the Graduate Assistant and Dr. Daniel Sivek.

A three-day training session was developed to prepare the CAs for classroom
instruction. The training session, conducted by the Graduate Assistant, consisted of
lectures on basic forestry material (based on the UW-SP summer course “A Survey of
Forestry” taught by Dr. Hans Schabel) and presentation and practice of the Project
FOR.E.S.T. activities. Environmental education professors and natural resources
graduate students attended these practice instruction sessions and offered feedback on
how the instruction might be improved. The practice sessions were videotaped in order
for the CAs to review and refine their teaching practices. The GA and CAs then met to
discuss suggestions and make the appropriate changes to instruction techniques. At
this point, the GA considered Project FOR.E.S.T. ready for classroom trial. The
Graduate Committee approved this decision.

The two CAs and the Graduate Assistant, in final preparation of full
instruction, together taught the Project FOR.E.S.T. unit in the first three classrooms
(these "trial" classrooms were not student or teacher surveyed as discussed below).

This team instruction was to provide practical experience in unit instruction. The GA and CAs met repeatedly in this stage to discuss improvements and changes to instruction. After instruction in the first three classrooms, CAs verbally expressed confidence in solo instruction of the unit. The GA approved of their solo instruction based on their confidence and also on direct observation. At this point both CAs and the GA individually taught the unit and were considered by the Graduate Assistant to be proficient instructors of the unit.

Classroom Assistants and the Graduate Assistant taught the unit in fifth grade classrooms across Portage, Marathon, Waupaca, and Marquette counties in Central Wisconsin during the January-May 2002 and August-December 2002 semesters. Each unit instructor taught the entire three lessons to an individual classroom within a one week period. The entire unit and additional resources (Appendix D), including a copy of Wisconsin Forests Forever, were left with all teachers to encourage continued instruction of the activities in future years.

The project grant specified that any public school fifth grade classroom in Portage, Marquette, Waupaca, and Marathon counties was eligible to receive Project FOR.E.S.T. instruction. In order to publicize and obtain permission to instruct the project, all public school district Curriculum Coordinators within the above counties were contacted between September and December 2001 (for example contact letters see Appendix F). The unit was outlined and presented to curriculum coordinators, and permission to include the fifth grades in their district was sought. The process by
which the unit should be promoted to the individual teachers was left up to the Curriculum Coordinator and varied by district. In certain instances the Graduate Assistant was given permission to contact individual fifth grade teachers or school principals. In others, the Curriculum Coordinator agreed to present the project to teachers and/or principals in their district at staff meetings. The method of contact was individualized and left up to the Curriculum Coordinator to ensure that each district was allowed to follow its own protocol.

SUBPROBLEM TWO: TO MEASURE THE UNIT'S ENVIRONMENTAL EDUCATION EFFECTIVENESS THROUGH A PRE- AND POSTTEST OF FIFTH GRADERS' KNOWLEDGE AND ATTITUDES REGARDING SELECTED FORESTRY TOPICS AND ISSUES

TEST ITEM DEVELOPMENT

Funding from the WEEB grant for Project FOR.E.S.T. provided for the analysis of unit effectiveness through pre- and posttest evaluation. Based on a study of previously published literature (see Chapter 2), a multiple-choice test for knowledge evaluation and a Likert-style test for attitude evaluation were utilized. Additionally, two questions were included as a “write-in” as the researcher and Graduate Committee did not believe that an effective Likert-style or multiple-choice question could be written for objective number nine and eleven (Appendix B), items that related to
identifying products from forest resources and personal actions for forest resource conservation.

A pool of questions and statements (for knowledge and attitudes, respectively) was developed based on the Project FOR.E.S.T. goals and objectives and conceptual framework. A validity panel was selected to review, edit, and select questions from this pool. The validity panel consisted of UW-SP education professor Dr. Jay Price, UW-SP forestry professor Dr. Hans Schabel, UW-SP environmental education professors Dr. Daniel Sivek and Dr. Dennis Yockers, and Edgar Elementary School fifth grade teacher and UW-SP master student Jon Albee.

The pool of questions and statements was submitted to each validity panel member. An accompanying letter for each panel member (Appendix G) was included with the question pool, which provided guidelines upon which each member was to base their validity evaluation. Guidelines were specific to each panel member, though they all shared many elements. Again, each specific letter is included in Appendix G. Guidelines for the Graduate Committee focused most specifically on the accuracy and bias of the test items. Guidelines for education professor Jay Price and the fifth grade teachers focused more specifically on the appropriateness for the fifth grade audience. Finally, guidelines for forestry professor Hans Schabel focused on the each item’s appropriateness in testing forestry knowledge and attitudes. After the validity panel members completed their reviews, the pool of questions was revised, re-submitted, and re-revised to obtain a final version of test questions. All panel members approved the final version.
The questions were assembled and formatted into a test based on a previous study of environmental literacy of Wisconsin fifth graders (Quale 1993). Directions were included on the test itself and also outlined in the teacher letter accompanying the tests (Appendix H). Practice items were also included for each section. The test document (Appendix I) functioned as both the pretest and the posttest. The pre- and posttest differed only in the times at which they were administered (see discussion of "control" and "experimental" groups below). The Graduate Committee approved this final version of the test.

The test and protocols for the testing procedures were then submitted to the Institutional Review Board (IRB) at the University of Wisconsin—Stevens Point. The Project FOR.E.S.T. test and protocol were approved by the IRB contingent upon a signed teacher consent form (Appendix J) and written approval from District Administrators (example form provided in Appendix K). The IRB approved a waiver of student consent based on the fact that the test differed little from what would normally be encountered in a fifth grade classroom on a given day. Students and teachers were given the option not to participate in testing. Student anonymity was protected in that students were instructed only to place their first name and last initial on testing documents, and all name information was discarded after test analysis.
ADMINISTRATION OF THE PRE- AND POSTTEST

After its approval by the IRB, the test was administered to certain classrooms receiving instruction in January and early February 2002. The results of these early tests were not reported as part of the final results of the study, but instead the early testing was used as an evaluation of the test document itself. These initial classroom teachers reported no problems with the test and its administration, therefore the test was considered ready for official use in the pre- and posttesting manner and was administered as such from that point on.

As mentioned, the pre- and posttest are identical documents. In this way, changes in student knowledge and attitudes surrounding forestry and forest-related topics could be assessed by comparing scores and figures from tests taken before and tests taken after instruction of Project FOR.E.S.T. A control group of student was needed to take both tests without Project FOR.E.S.T. instruction, following the "Pretest-Posttest Control Group Design" outlined in Leedy (1993). Based on conversations with Dr. Jay Price it was decided that it was optimal to minimize the high variability that exists between individual districts and within schools themselves (in terms of instruction styles, student makeup, prior knowledge, environmental education, forestry experience, etc). Therefore, the decision was made to obtain a control group (one entire classroom) from each school in which an experimental group was obtained. If a school only had one participating classroom, no testing occurred.
The process for administering Project FOR.E.S.T. is summarized in Figure 3.1. First, permission was obtained from the District Administrator to conduct testing. For schools with two or more participating classes, the teachers were then contacted and permission for testing requested. Next, the "control" and "experimental" classes were randomly decided by coin toss. In schools with more than two classrooms, one control was selected and one of the remaining classrooms functioned as experimental groups (again decided by a coin toss). Once the control and experimental groups were designated, testing materials were sent to the teacher(s) with instructions for administration (for an example letter, see Appendix J). The tests were sent to teachers at least one week in advance of instruction due to the nature of the testing process: control groups took the pretest approximately one week before instruction, and then a second time (the "posttest") just before instruction, having had one week pass since pretesting.

For a diagram of the experimental design, see Figure 3.2. The experimental group only took the pretest just before instruction. The posttests for the experimental group were then brought to the teacher on the final day of instruction and left with a postage-paid envelope so that the completed tests could be sent back to the researcher after having been administered during the week following instruction. In this way both the students in the control and the experimental groups received Project FOR.E.S.T. instruction but true experimental design (Leedy 1993) could be obtained.
Figure 3.1: Complete process for administration of Project FOR.E.S.T.

**Step 1**
- Obtain signed permission to instruct from District Administrator

**Step 2**
- Contact principals/teachers
- Set up teaching times (all 3 lessons taught within one week)
- Obtain verbal permission to test students

**Step 3**
- Randomly select control and experimental classrooms
- Send control pretests and posttests, consent forms, and experimental pretests to school

**Step 4**
- Control: pre- and posttests administered, one week apart
- Experimental: pretest administered

**Step 5**
- Teach complete Project FOR.E.S.T. in each classroom within one week's time

**Step 6**
- Experimental: administer posttest after instruction
- Administer teacher survey
Students completed each test by entering their multiple-choice answers into a Scantron form, as well as by completing the fill-in answers on the test form itself. Scantron answers for test items 1-20 were recorded at the Survey Processing Office at Administrative Information Systems at UW-SP. The write-in answers were hand-scored by the researcher using the rubric created by the researcher and reviewed and approved by the Graduate Committee (Appendix L). These value for the multiple-choice as well as the write-in items were transferred into the computer program SPSS.

The knowledge-testing portion of the multiple-choice test (items 1-12) was scored in SPSS by assigning a value of “1” to correct answers, and a value of “0” to all other answers. Write-in answers were assigned a value of 1,2, or 3 based on the scoring system developed as part of the rubric (Appendix L). In total, items 1-12 and the two write-in answers comprised the “knowledge” section of the test. A score of 18 was considered a perfect grade for this section of the test, with one point each for items 1-12 and 3 points for each write-in.

The section of the testing used for assessing student attitudes about forestry and forest resources was a Likert-style scale system. Items 13-20 comprised this section of the testing instrument. Students entered their responses to these items into a Scantron form, which were processed by the Survey Processing Office at UW-SP. In order to mark any changes in student attitudes, responses to the Likert-style portion of the survey were then assigned values in SPSS. The researcher and the graduate
committee reviewed items 13-20 and unanimously decided that there were “optimal responses” to each question, in terms of a positive attitude about forestry and forest resources. These optimal responses were assigned a value of “5” in SPPS, and values of 4 through 1 were assigned to the responses that were progressively farther from the optimal response. Appendix M highlights those responses chosen as optimal as well as the values assigned to all other responses. In this way score of 40 was the highest
possible score on the attitudinal portion of the survey, which would occur when a score of 5 was received for each item, 13-20.

Student responses were tracked by assigning a numeric code to each student. The code revealed the classroom from which the student came (noting that control and experimental groups were taken in each case from the same school), and also whether the student was from a “control” or “experimental” group, and whether the test was pre- or post. Using SPSS, the researcher ascertained the numeric changes in student scores between pre- and posttesting for both knowledge and attitude. These “gain scores” were then used in the statistical analysis of unit effectiveness. Statistical analysis was conducted again using the computer program SPSS. The researcher conducted an analysis of covariance (ANOVA) using the gain score as the dependent variable, and considering the experimental and control groups, as well as the separate schools, fixed factors. In this way, the statistical test might reveal the average gain score, the significance in comparing net gain score in the experimental treatment with that that might be gained from pure chance, and would also reveal changes that occurred due to the interaction of variables associated with schools (i.e., variability between district requirements, maturation between pre- and posttesting, etc.). The unit was to be considered effective if it were shown that statistically significant (alpha level 0.05) positive changes occurred in knowledge and/or attitudes.
SUBPROBLEM THREE: TO EVALUATE, WITH A POST-UNIT TEACHER SURVEY, OPINIONS ON UNIT Appropriateness AND EFFECTIVENESS, TEACHER WILLINGNESS TO INCORPORATE FOREST AND FORESTRY EDUCATION INTO CLASSROOM CURRICULA, AND THE VALUE OF IN-SERVICE TRAINING IN FOREST AND FORESTRY EDUCATION

TEACHER SURVEYS

A main aim of the project was to increase teacher awareness and use of forestry environmental education resources. It was thought, based on analysis in previous studies, that in-class teacher training would encourage EE most especially for those teachers who might not otherwise be exposed to the field or its resources. It was believed that seeing an effective forestry EE unit taught in their own classroom might encourage teachers to teach the unit themselves to future classes and/or explore other EE resources.

The researcher developed a survey dealing with teacher willingness to incorporate the unit into his/her classroom curricula (Appendix N). The researcher, primarily through conversations with the Project Advisor Dr. Dan Sivek, developed questions for the survey. The process was guided by the elements of project subproblem three, listed above. Questions included inquiries as to whether in-class instruction by the CAs had influenced teachers’ views on forestry/environmental education as well as questions dealing with the primary goal of assessing willingness
to incorporated forest and forestry lessons into classroom curricula. Certain test items (ultimately items 8 and 9) were included to assist the researcher and CAs in evaluating their own teaching effectiveness and were not included as an evaluation component of the subproblem. The draft survey and questions were submitted to the Graduate Committee for review. Edits and revisions were made as necessary, and all committee members approved a final version. These questions were assembled into a multiple-choice survey that was issued to teachers on the final day of Project FOR.E.S.T. instruction and then sent to the researcher. The teacher entered responses to each item on a Scantron form provided with the survey. The survey document itself also provided room for written responses/comments to each item. Teacher identity remained anonymous in reporting of the findings. The Institutional Review Board of the University of Wisconsin—Stevens Point approved the teacher survey, requiring a signed consent form for any participating teacher (example form provided in Appendix J).

The Scantron results of the surveys were processed by the Survey Processing Office at UW-SP, and then entered into the computer program SPSS for analysis. The researcher also reviewed written comments and selected those deemed noteworthy or exemplary of common Scantron responses for inclusion in the reporting of the results. Using SPSS, the total and mean responses for each survey item were calculated and graphed.

Additional evaluation of teacher incorporation of the unit was done in February of 2003. Teachers that received the unit the previous spring were re-surveyed by
electronic mail. The re-survey was purposely kept brief (four items) to encourage a high response rate. The survey focused on actual implementation that may have occurred since instruction as opposed to intended implementation, as studied with the original teacher survey. Non-respondents were re-contacted with a separate e-mail. The Graduate Committee again reviewed the questions in this survey and a final version was approved after draft revisions (Appendix O). The survey contained 4 items.

Responses to the re-survey were entered into SPSS and tabulated in a manner similar to that of the original survey. Item Q4 was strictly teacher comments, and not analyzed in SPSS. The results of items Q1 through Q3 were analyzed in SPSS, and therefore responses were assigned a numeric code as follows: A response of “No” was assigned a value of 0. A response of “Yes” was assigned a value of 1 in item Q3. For item Q1, and Q2, the “Yes” response was quantified by the number of lessons actually implemented. For instance a teacher might have responded to item Q1 by indicating they had implemented 3 of the project forest lessons. Therefore, for items Q1 and Q2 “Yes” responses were assigned a value of 1, 2, or 3 as appropriate. Teachers receiving classroom instruction in the fall of 2002 were not re-surveyed, as there would have been insufficient time for unit implementation.
CHAPTER FOUR-RESULTS

STATEMENT OF THE PROBLEM

The purpose of this study was to develop and evaluate the use of a fifth grade forestry education unit taught by trained environmental educators as a tool to improve environmental education in four Wisconsin counties. The results of the research and analysis will be presented for each of the three component sub-problems of the study.

SUBPROBLEM 1: TO DEVELOP A MULTI-DISCIPLINARY, FIFTH GRADE, 3-LESSON FORESTRY EDUCATION UNIT THAT COULD BE INCORPORATED INTO INDIVIDUAL TEACHERS’ CURRICULA AFTER INSTRUCTION BY TRAINED ENVIRONMENTAL EDUCATORS

The unit development process was highlighted in Chapter Three of this report and resulted in the complete Project FOR.E.S.T. unit that is included in Appendix D. A summary of the lessons is as follows:

Lesson One of Project FOR.E.S.T. dealt with the biotic and abiotic elements of a forest and introduced the concept of sustainable forestry. The lesson contained aspects of science, social studies, art, and environmental education. Lesson Two dealt with tree biology and contained elements of science, environmental education, and performing arts. Lesson Three covered forest utility and reinforced concepts of...
sustainable forestry. Only the first three lessons were taught by CAs, but two additional lessons were included should teachers wish to expand future forestry units. Lesson Four contained aspects of social studies, science, and environmental education. Lesson Four covered tree growth and measurement and was mathematics-based, though also included elements of science and environmental education. Finally, Lesson Five summarized ideas about sustainable forestry and forest use and addresses concepts appropriate to language arts, science, social studies, and environmental education.

This unit was taught to over 50 teachers in 29 schools in Portage, Marathon, Marquette, and Marathon counties. A total of approximately 1,300 students in 67 classrooms received instruction as part of this unit.

SUBPROBLEM TWO: TO MEASURE THE UNIT’S ENVIRONMENTAL EDUCATION EFFECTIVENESS THROUGH A PRE- AND POSTTEST OF FITH GRADERS’ KNOWLEDGE AND ATTITUDES REGARDING SELECTED FORESTRY TOPICS AND ISSUES

A total of 342 students in 10 schools completed the pre- and posttest. Each school’s participating students were divided into control and experimental groups, as previously discussed, with a total of 178 students serving as “controls” and 164 students serving as “experimental”. See Table 4.1 for a summary of the number of students tested for each treatment and each school.
Table 4.1: Number of students in each testing treatment, listed by school

<table>
<thead>
<tr>
<th>School</th>
<th>Number of Control Students</th>
<th>Number of Experimental Students</th>
<th>Total Tested Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>19</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>22</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>16</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>25</td>
<td>49</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>17</td>
<td>35</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>TOTALS</td>
<td>178</td>
<td>164</td>
<td>342</td>
</tr>
</tbody>
</table>

CHANGES IN STUDENT KNOWLEDGE OF FORESTS AND FORESTRY

Multiple-choice items 1-12 and the two write-in items on the testing document (Appendix I) comprised the forest and forestry knowledge section. The mean gain score for students in the control group (those students completing both pre- and posttest before Project FOR.E.S.T. instruction) for this section was 0.48. The mean gain score for students in the experimental group (those students receiving Project FOR.E.S.T. between pre- and posttesting) was 2.71 (Table 4.2). This means that the students in the experimental group gained an average of 2.71 points between the pretest and the posttest administered.
Table 4.2: Mean gain scores by treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean Gain Score—Knowledge</th>
<th>Mean Gain Score—Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.48</td>
<td>0.38</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.71</td>
<td>1.63</td>
</tr>
</tbody>
</table>

Analysis of variance (ANOVA) considering only the effect of control and experimental grouping (excluding school grouping effects) indicated a statistically significant difference between the experimental and control group gain scores, with an F value of 58.735 (p=0.000). An ANOVA test considering only school grouping effects, excluding control/experimental groupings, also revealed a statistically significant difference (F= 2.506, p=0.009). Finally, the ANOVA test considering the interaction effect of school and experimental/control grouping also indicated statistically significant difference (F=2.699, p=0.005). The R Squared value for the knowledge ANOVA was 0.254; adjusted R Squared was 0.210. See Table 4.3 for a complete summary of the results of ANOVA tests for the knowledge sections. In summary, these results indicate that the mean gain knowledge score between students in the experimental and control groups is significantly different, even when considering the effects of between-school variations and experimental/control grouping.
Table 4.3: ANOVA test of between-subject effects for knowledge changes

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control or Exp</td>
<td>1</td>
<td>58.735</td>
<td>0</td>
</tr>
<tr>
<td>School</td>
<td>9</td>
<td>2.506</td>
<td>0.009</td>
</tr>
<tr>
<td>Control/Exp * School</td>
<td>9</td>
<td>2.699</td>
<td>0.005</td>
</tr>
</tbody>
</table>

CHANGES IN STUDENT ATTITUDES ABOUT FORESTS AND FORESTRY

Likert-style multiple-choice items 13-20 of the testing document comprised the forest and forestry attitude section. The mean gain score for students in the control group (those students completing both pre- and posttest before Project FOR.E.S.T. instruction) for this section was 0.38. The mean gain score for students in the experimental group (those students receiving Project FOR.E.S.T. between pre- and posttesting) was 1.63. (Table 4.2). This means, for example, that the students in the experimental group gained an average of 1.63 points between the pretest and the posttest administered.

Analysis of variance (ANOVA) considering only the effect of control and experimental grouping (excluding school grouping effects) indicated a statistically significant difference between the experimental and control group gain scores, with an F value of 5.827 (p=0.016). An ANOVA test considering only school grouping effects, excluding control/experimental groupings, did not reveal a statistically significance difference in mean gain scores (F=0.897, p=0.528). Finally, a statistically significant difference in mean gain scores was revealed by an ANOVA test.
considering the interaction effect of school and experimental/control grouping (F=2.257, p=0.019). The R Squared value for the attitudinal ANOVA was 0.102; adjusted R Squared was 0.048. See Table 4.4 for a complete summary of the results of ANOVA tests for the knowledge sections. In summary, these results indicate that there was a significant difference between experimental and control groups in regard to attitudinal gain scores, even when considering the interaction effect of school-to-school variation and experimental/control grouping.

Table 4.4: ANOVA test of between-subject effects for attitude changes

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control or Exp</td>
<td>1</td>
<td>92.210</td>
<td>0.016</td>
</tr>
<tr>
<td>School</td>
<td>9</td>
<td>14.199</td>
<td>0.528</td>
</tr>
<tr>
<td>Control/Exp * School</td>
<td>9</td>
<td>35.710</td>
<td>0.019</td>
</tr>
</tbody>
</table>

SUBPROBLEM THREE: TO EVALUATE, WITH A POST-UNIT TEACHER SURVEY, OPINIONS ON UNIT APPROPRIATENESS AND EFFECTIVENESS, TEACHER WILLINGNESS TO INCORPORATE FOREST AND FORESTRY EDUCATION INTO CLASSROOM CURRICULA, AND THE VALUE OF IN-SERVICE TRAINING IN FOREST AND FORESTRY EDUCATION

A total of 47 teachers participating in the unit completed the survey assessing willingness to incorporate forestry lessons into their curriculum. Only the first item was a yes/no response. Responses to items 2-12 were on a Likert-style scale from
“Strongly Agree” to “Strongly Disagree”. Results were calculated by assigning “yes” or “strongly agree” a value of 1, with progressive responses receiving progressively higher values. Therefore, “no” was marked at a value of 2 whereas “agree”, “neutral”, “disagree”, and “strongly disagree” were given the values 2, 3, 4, and 5 respectively. This was done for ease of processing and reporting of findings. For example, if a Teacher A’s response to a statement was “Agree”, the item would be marked as a 2. If Teacher B responded to the same question by choosing “Strongly Disagree”, the response would be reported as a 5.

Table 4.5: Frequency of responses for each item in the teacher survey, n=47.

<table>
<thead>
<tr>
<th>Item number</th>
<th>Response</th>
<th>St. Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>St. Disagree</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>Q2</td>
<td></td>
<td>32</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q3</td>
<td></td>
<td>32</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q4</td>
<td></td>
<td>19</td>
<td>14</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q5</td>
<td></td>
<td>13</td>
<td>21</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q6</td>
<td></td>
<td>19</td>
<td>18</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q7</td>
<td></td>
<td>0</td>
<td>6</td>
<td>11</td>
<td>23</td>
<td>4</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q8</td>
<td></td>
<td>44</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q9</td>
<td></td>
<td>44</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q10</td>
<td></td>
<td>35</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q11</td>
<td></td>
<td>28</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Q12</td>
<td></td>
<td>28</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The following section will present the responses for each of the twelve survey items. Though there was space designated for teacher comments after each question, these results are not being reported here as teachers did not widely utilize these spaces.
for comments. Results, then, are best gained from a study of the quantifiable chosen responses to each Likert-style question. Table 4.5 summarizes the frequency of response results, listing each item in order, and designated Q1 through Q12. Table 4.6 summarizes the descriptive statistics for each survey item. Appendix P presents the responses in a graph format. For a complete per-item analysis of responses, see Appendix Q. It should again be noted that certain test items (specifically items 8 and 9) were included to assist the researcher and CAs in evaluating their own teaching effectiveness and were not included as an evaluation component of the subproblem. Though results for all items are reported here, only those items expressly dealing with teacher willingness to incorporate forest-related lessons into their classroom curriculum, opinions about unit effectiveness and appropriateness, and items expressly dealing with the effectiveness of in-service training will be discussed in Chapter 5.

Table 4.6: Descriptive statistics for each item in the teacher survey*.

<table>
<thead>
<tr>
<th>Item number</th>
<th>Mean</th>
<th>Median</th>
<th>St.Dev.</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>1.780</td>
<td>2.000</td>
<td>0.421</td>
<td>1.000</td>
</tr>
<tr>
<td>Q2</td>
<td>1.320</td>
<td>1.000</td>
<td>0.471</td>
<td>1.000</td>
</tr>
<tr>
<td>Q3</td>
<td>1.320</td>
<td>1.000</td>
<td>0.471</td>
<td>1.000</td>
</tr>
<tr>
<td>Q4</td>
<td>1.890</td>
<td>2.000</td>
<td>0.840</td>
<td>2.000</td>
</tr>
<tr>
<td>Q5</td>
<td>2.000</td>
<td>2.000</td>
<td>0.752</td>
<td>2.000</td>
</tr>
<tr>
<td>Q6</td>
<td>1.770</td>
<td>2.000</td>
<td>0.859</td>
<td>4.000</td>
</tr>
<tr>
<td>Q7</td>
<td>3.570</td>
<td>4.000</td>
<td>0.846</td>
<td>3.000</td>
</tr>
<tr>
<td>Q8</td>
<td>1.060</td>
<td>1.000</td>
<td>0.247</td>
<td>1.000</td>
</tr>
<tr>
<td>Q9</td>
<td>1.060</td>
<td>1.000</td>
<td>0.247</td>
<td>1.000</td>
</tr>
<tr>
<td>Q10</td>
<td>1.260</td>
<td>1.000</td>
<td>0.441</td>
<td>1.000</td>
</tr>
<tr>
<td>Q11</td>
<td>1.430</td>
<td>1.000</td>
<td>0.542</td>
<td>2.000</td>
</tr>
<tr>
<td>Q12</td>
<td>1.490</td>
<td>1.000</td>
<td>0.655</td>
<td>2.000</td>
</tr>
</tbody>
</table>

*Please note: a value of 1 would correlate to “Strongly Agree” while a value of 5 would correlate to “Strongly Disagree” and so on. In the case of Q1, “Yes” is give a value of 1, “No” has a value of 2.
Q1: *I have previously taught about sustainable forestry in my classroom.*

Thirty-five teachers participating in Project FOR.E.S.T. chose a “no” response to this item, while 10 responded with “yes”.

Q2: *The time allotted to instructing the lessons was appropriate.*

Thirty-two teachers chose “strongly agree” in association with this item, while 15 chose “agree”. No teachers chose “neutral”, “disagree”, or “strongly disagree”. The mean was 1.32, the median 1.00, the standard deviation 0.471, and the range was 1.0.

Q3: *The lessons were at an appropriate level for my classroom.*

Thirty-two teachers chose “strongly agree” in association with this item, while 15 chose “agree”. No teachers chose “neutral”, “disagree”, or “strongly disagree”. The mean was 1.32, the median 1.00, the standard deviation 0.471, and the range was 1.0.

Q4: *I will incorporate these lessons into my classroom curriculum next year.*

Nineteen teachers chose “strongly agree” in association with this item. Fourteen teachers each chose “agree” and “neutral”, while no teachers chose the responses “disagree” or “strongly disagree”. The mean for this item was 1.89, the median was 2.00. The standard deviation was 0.471 while the range was 2.0.
Q5: *I will incorporate other forestry lessons into my classroom curriculum.*

Thirteen teachers chose "strongly agree", 21 chose "agree", and 13 chose "neutral" in response to this item. No teachers chose either of the disagreement options. The mean and median response was 2.0. The standard deviation was 0.752. The range was 2.0.

Q6: *(If intending to use forestry lessons in the future): Having the forestry unit taught in my classroom influenced my decision to use these or similar lessons in my classroom.*

In association with this item, 19 teachers chose "strongly agree", 18 teachers chose "agree", 6 teachers chose "neutral", no teachers chose "disagree", and one teacher chose "strongly disagree" (without any additional written comments). The mean for this item was 1.77 while the median was 2.00. The standard deviation was 0.859. The range was 4.0.

Q7: *(If intending to use forestry lesson in the future): Receiving the written materials (without instruction by the EE specialist) would have been enough for me to decide to use the lessons in my classroom.*

No teachers completing the survey chose "strongly agree" in association with this test item. Six chose "agree", 11 chose "neutral", 23 chose "disagree", and 4 chose
"strongly disagree". The mean and median responses were 3.57 and 4.0 respectively.
The standard deviation was 0.846 and the range was 3.0.

Q8: The Environmental Education Specialist(s) who visited my classroom were punctual.

Forty-four teachers chose "strongly agree" while 3 chose "agree" in association with this statement. No teacher chose any of the remaining responses. The mean was 1.06 for this response. The median and range were both 1.0. The standard deviation was 0.247.

Q9: The Environmental Education specialist(s) who visited my classroom were professional and effective instructors.

Forty-four teachers chose "strongly agree" while 3 chose "agree" in association with this statement. No teacher chose any of the remaining responses. The mean was 1.06 for this response. The median and range were both 1.0. The standard deviation was 0.247.

Q10: My students gained valuable information about sustainable forestry and forest-related topics.

No teachers chose "neutral", "disagree", or "strongly disagree" in association with this survey item. Conversely, 35 teachers chose "strongly agree" and 12 chose
agree”. The mean and median of 1.06 and 1.00 respectively were associated with a standard deviation of 0.247 and a range of 1.0.

Q11: I gained valuable information about sustainable forestry and forest-related topics.

In response to this item, 28 teachers chose “strongly agree”, 18 chose “agree”, 1 chose “neutral”, and no teachers chose “disagree” or “strongly disagree”. There was a mean of 1.43, a median of 1.0, a standard deviation of 0.542, and a range of 2.9 associated with this response.

Q12: I gained valuable information about how to teach about sustainable forestry and forest-related topics.

Twenty-eight teachers chose “strongly agree”, 15 chose “agree”, and 4 chose “neutral” in response to this item. No teachers chose either of the disagreement responses. The mean for this response was 1.49, the median was 1.00, the standard deviation was 0.655 and the range was 2.0.

Teachers who received Project FOR.E.S.T. instruction in the spring of 2002 were re-surveyed in the fall of that same year, as previously discussed. The response rate for the re-survey was 54%, with 13 of the 24 teachers providing responses.

The following section will present the results from responses for each four survey items. Exemplary teacher comments, as selected by the researcher, will also be
included in the following section. Table 4.7, 4.8, and 4.9 summarize the statistical results of items Q1-Q3, noting that item Q4 was strictly teacher comments, therefore receiving no statistical analysis. When considering these results, please note that one teacher responded to the survey with comments only, and made no selection of the given responses.

Q1: *I have implemented in my classroom at least one of the three Project FOR.E.S.T. lessons taught by the UW-SP Classroom Assistant(s).*

Five teachers (38.5%) responded to this item by choosing “No”. Three teachers (23.1%) indicated that they have implemented one lesson. No teachers had implemented two lessons, but 4 teachers (30.8%) indicated that they have implemented 3 Project FOR.E.S.T. lessons in their classroom curricula. Comments for this item tended to focus time issues as barriers to implementation. Two examples follow:

“I like the program and may still do it sometime this year. As always, there is never enough time in the year.”

“We usually do forestry lessons in the spring, closer to Arbor Day.”
Table 4.7: Descriptive statistics for teacher re-survey item Q1

<table>
<thead>
<tr>
<th>Item Q1</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;No&quot;</td>
<td>5</td>
<td>38.46154</td>
</tr>
<tr>
<td>&quot;Yes, one lesson&quot;</td>
<td>3</td>
<td>23.07692</td>
</tr>
<tr>
<td>&quot;Yes, two lessons&quot;</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&quot;Yes, three lessons&quot;</td>
<td>4</td>
<td>30.76923</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>92.30769</td>
</tr>
<tr>
<td>Missing System</td>
<td>1</td>
<td>7.692308</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

Q2: I have implemented in my classroom at least one of the two additional Project FOR.E.S.T. lessons provided in the lesson plans, but not taught by the UW-SP Classroom Assistant(s) (i.e., Lesson Four and Lesson Five).

Eight teachers (61.5%) indicated that they had not implemented any of the additional lessons. Two teachers each (23.1%) indicated that they have implemented one and two lessons. Only two teachers provided comments for this item, their responses follow:

"I haven’t looked real closely at my overall plan for this unit yet. I will do so as I get closer to teaching it. There is a good chance that I will include an additional lesson or follow the ideas within an additional lesson."

"We rotate curriculum each year, so this year we are teaching fifth grade curriculum, where forestry lessons best fit into our sixth grade curriculum. Next year I plan to use the lessons."
Table 4.8: Descriptive statistics for teacher re-survey item Q2

<table>
<thead>
<tr>
<th>Item Q2</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;No&quot;</td>
<td>8</td>
<td>61.53846</td>
</tr>
<tr>
<td>&quot;Yes, one lesson&quot;</td>
<td>2</td>
<td>15.38462</td>
</tr>
<tr>
<td>&quot;Yes, two lessons&quot;</td>
<td>2</td>
<td>15.38462</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>92.30769</td>
</tr>
<tr>
<td>Missing System</td>
<td>1</td>
<td>7.692308</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

Q3: In my classroom, I have implemented other forestry lessons, aside from those found in Project FOR.E.S.T., since receiving in-class instruction from UW-SP Classroom Assistant(s).

Seven teachers (53.8%) indicated that they had not implemented any type of forestry lesson since Classroom Assistant instruction. Conversely, four teachers (30.8%) indicated that they had implemented forestry lessons other than those contained in Project FOR.E.S.T. Only one teacher provided comments:

"Again, this is always a possibility. I will have to decide as I begin planning for this unit. I usually try to add/change things from year to year with various units as new materials/ideas are found."
Table 4.9: Descriptive statistics for teacher re-survey item Q3

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>&quot;No&quot;</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>&quot;Yes&quot;</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Missing</td>
<td>System</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>

Q4: If you haven’t implemented forestry lessons, please briefly describe any barriers to your teaching them, or conversely anything that might encourage you to teach such lessons in the future.

Three teachers provided responses to this item. These responses are as follows:

“School district standards and benchmarks have become very time consuming and limiting to other activities. Also, this year I have switched to only teaching social studies and not science.”

“…our curriculum dictates what is taught, and when. Because of our rotating curriculum due to our 5/6 split classrooms, I am on a two year cycle for what is taught. I do appreciate the work you all did in my classroom, and look forward to implementing some of the lessons on my own next year. Thanks!”

“Honestly, I’d like to use some of the lessons. They were good and the kids liked them. I [lost the materials]…could you please send me another copy?”
CHAPTER FIVE-SUMMARY, INTERPRETATIONS, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The purpose of this study was to develop and evaluate the use of a fifth grade forestry education unit taught by trained environmental educators as a tool to improve environmental education in four Wisconsin counties. To accomplish this goal, the researcher developed the format and instruction of a three-lesson, fifth grade forestry unit and associated teacher and student surveys to assist in assessment of the unit. Student surveys, in the form of pre- and posttests, assessed changes in knowledge and attitudes about forests and forestry after having participated in Project FOR.E.S.T. Teacher surveys assessed willingness to include forest and forestry lessons in classroom curricula, and the effects of in-class instruction in Project FOR.E.S.T.

GAINS IN STUDENT KNOWLEDGE OF FORESTS AND FORESTRY

The results gained from analysis of the cognitive portion of the student test suggest that the instruction of Project FOR.E.S.T. contributes to student knowledge gain in subjects related to forests and forestry. On average, students were shown to be achieving scores 2.71 points higher after receiving instruction (p=0.005), significantly higher than control groups even when considering school-to-school variability. This is
justification for concluding that instruction in Project FOR.E.S.T. contributes significantly to student knowledge in forest- and forestry-related topics. The test on which students increased their knowledge included elements of tree biology, concepts of sustainable forestry, and concepts surrounding forest utility. This research suggests that a short unit consisting of three 50-minute lessons instructed over the course of one week can be an effective tool in contributing to the education of students in fifth grade about forest ecology and forestry, in this case important aspects of local environments and industry.

GAINS IN STUDENT ATTITUDES ABOUT FORESTS AND FORESTRY

The results gained from analysis of the affective portion of the student test suggest that the instruction Project FOR.E.S.T. contributes to the development of positive attitudes related to forests and forestry. Because a validity panel decided that there were “optimal responses” to each attitude statement, it was possible to “score” the affective portion of the student test. On average, students were shown to be achieving scores 1.63 points higher after receiving instruction (p=0.016), with no interaction effect for school-to-school variation apparent. This is justification for concluding that instruction in Project FOR.E.S.T. contributes significantly to positive changes in forest- and forestry-related attitudes in fifth grade students. Students increased their positive responses on test items that assessed views on sustainable natural resource use, forest conservation, and the importance of forests in Wisconsin’s
economy. The research suggests that even a short unit consisting of three 50-minute lessons instructed over the course of one week can be an effective tool in contributing to changes in student attitudes about their local environment.

EFFECTIVENESS AND APPROPRIATENESS OF PROJECT FOR.E.S.T. ACCORDING TO PARTICIPATING TEACHERS

This section will explore the results from the teacher survey items that expressly addressed teacher opinions on the effectiveness and appropriateness of Project FOR.E.S.T. The results suggest that Project FOR.E.S.T. is effective in not only increasing teacher knowledge of forests and forestry and how to teach about such topics, but in increasing teacher use of resources covering these topics. In total, the results of the teacher survey support the research (Chapter Two) that suggests locally-focused, short, in-service teacher education can increase the use of environmental education materials. These results will be helpful for those considering aspects of design and distribution of environmental education materials.

Previous studies suggest the use of locally focused lessons as a method to increase the effectiveness of teacher training. This was an important component of the development of Project FOR.E.S.T. The forest products industry is the second biggest industry in Wisconsin, and the state has a long history of forest usage. Increasing the understanding of the importance of forestry in Wisconsin and the instruction of forestry lessons was a primary goal of the grant that funded this project. The post-
instruction surveys indicated that teachers believed that they and their students did in fact gain valuable knowledge about local environmental issues, in this case forests and forestry. According to teachers surveyed, Project FOR.E.S.T. effectively increases the student and teacher knowledge about forest and forestry topics while helping the teachers gain knowledge about how to teach about such topics. The reported effectiveness of Project FOR.E.S.T. in contributing to student and teacher knowledge is justification for instruction for the use of a forestry-education unit in Central Wisconsin.

Though this particular locally focused unit did increase teacher and student knowledge, according to the survey, these results are difficult to generalize. Because no comparisons were made to lessons that were less locally significant, it cannot be said that a forestry lesson was more effective in increasing knowledge than any other environmental education lesson. It can simply be concluded that the development of a forest education unit, based on literature that suggested using locally-focused lessons, did result in a knowledge gain for both teachers and students.

Studies of previous research also suggested that teacher training benefits from the use of relatively small-scale units. Furthermore, it is important to fully consider both the needs of the teachers and the student when developing lessons for classroom use. Much attention was focused on ensuring that Project FOR.E.S.T. lesson content was challenging but appropriate for fifth grade, and at the same time convenient for instruction by today's teachers, who have many demands on their time. The teacher survey suggests that these considerations helped make Project FOR.E.S.T. successful.
Project FOR.E.S.T. lessons were considered to be at the appropriate level and length for fifth grade instruction. Teachers strongly favored Project FOR.E.S.T. as an age-appropriate unit consisting of lessons that easily fit classroom time constraints.

Lastly, a review of related literature suggested that teacher training is effective when it is conducted as an in-service. The grant supporting Project FOR.E.S.T. focused heavily on the need to increase the use of forestry education materials in Wisconsin. Project FOR.E.S.T., therefore, was developed to function as an in-service unit that would encourage teacher use of it and other forest-related resources. The results of the teacher surveys suggest that indeed the project was effective in encouraging resource use, more so than if teachers had been sent materials alone (without in-class instruction).

Though a majority of teachers (75%) reported never having taught about sustainable forestry prior to receiving training in Project FOR.E.S.T., more than 70% of respondents then said that after having received training, they intended to incorporate Project FOR.E.S.T. and other forestry lessons into their classroom curricula. This strong willingness to teach about forests and forestry after training is highly supportive of the content and methodology of Project FOR.E.S.T. Furthermore, when directly asked about their decision to incorporate forest and forestry lessons into their curricula, most teachers (79%) agreed or strongly agreed that having Project FOR.E.S.T. taught in their classroom influenced their positive decision. At the same time, over half of these teachers felt that receiving written materials alone would not have been enough to influence them to incorporate the lessons into their curriculum
(survey item Q7). Together with the previous research that also indicates that the practice of sending out environmental education materials to schools alone, without training, may prove relatively ineffective in promoting use (Wilke, 1979), these results provide justification for considering in-service training when developing forest-related environmental education units. Program developers may wish to consider the results of this study when deciding on strategies for dissemination of their materials. If time and resources allow, in-service training in use of the lessons would likely prove beneficial.

TEACHER RE-SURVEY: REPORTED ACTUAL IMPLEMENTATION AND BARRIERS TO IMPLEMENTATION

The results of the teacher re-survey, used to assess actual implementation of the Project FOR.E.S.T. lessons, should be looked at with care. As opposed to the original teacher survey, which assessed the teachers' intentions in regards to unit usage, the re-survey attempted to assess actual implantation by questioning teachers about their usage one year later. Because of the timing available, teachers participating in the second semester of Project FOR.E.S.T. instruction were not re-surveyed and the final number of respondents was rather low for making solid conclusions. Furthermore the response rate of those who were surveyed is just over half. Therefore, these results should only be used as suggestions, and may not be subject to generalization. The combination of chosen responses and teacher comments, though, does allow for some
insight into the barriers to implementation of “outside” curricula or lesson plans such as Project FOR.E.S.T.

Again it should be noted that the number of participants in the re-survey is rather low for establishing patterns, yet the majority of re-survey respondents had in fact implemented at least one Project FOR.E.S.T. lesson from the three that were taught in class. There were not enough participants reporting implementation to make statistical comparisons to the proposed implementations reported in the first survey. Yet the combination of these re-survey results with the written responses provides support to the effectiveness of in-service training while at the same time suggesting reasons for reported non-implementation. Written responses to this first re-survey item (Q1) show support for the unit, with teachers commenting, “Next year I plan to use the lessons” and “I like the program and may still do it sometime this year.” Responding teachers indicated that lack of implementation is likely due to time issues, with teachers reporting that the lessons fit best in “spring” or “closer to Arbor Day” when they indicated they still planned to use the lessons. Consequently, waiting longer to re-survey teachers would likely have resulted in more evidence of actual implementation. Therefore, it is suggested that any lack of implementation is due to timing issues and not ineffectiveness of the Project FOR.E.S.T. unit.

In contrast to the re-survey reported use of Lessons One through Three, only a minority of respondents had implemented at least one of the additional lessons included in the unit but not instructed in class. This may relate to item Q7 of the original survey, which found that responding teachers generally agreed that written
materials alone are not enough to ensure classroom implementation. The reason for the lack of implementation of Project FOR.E.S.T. Lessons Four and Five may be due to the fact that they were not instructed in class, and teachers may not be convinced of their usability based solely on their written form. The only two written responses to this item, though, did in fact indicate willingness to use the additional lessons in the coming year. This contrast makes it difficult to draw conclusions from this item.

Only a minority of respondents indicated, in item Q3, that they had implemented other forestry-related lessons (not included in Project FOR.E.S.T.) in their classrooms. The combination of these results with those above may suggest that lack of training is a barrier to use of outside lessons. Again though, generalizations are difficult with the re-survey due to the low number of respondents and the short period of time available for implementation by the time the re-survey was conducted. The one written response to this item indicated that other lessons might in fact find a home in the classroom curricula in the coming year.

Finally, the fourth re-survey item (solely write-in responses) can suggest reasons Project FOR.E.S.T. or similar units may be difficult to implement, though the reasons indicated are not easily in the control of those creating the units. One teacher who commented on barriers to implementation indicated “school district benchmarks” have become “very time consuming and limiting to other activities”. Future studies may wish to look at the effects that standards and standardized testing have upon the use of “outside” activities or curricula. Project FOR.E.S.T. did attempt to address this concern by the inclusion of “fully or partially addressed state standards” in three of its
lessons. Other school district changes apparently were a detriment to the use of Project FOR.E.S.T. lessons. For example, two responding teachers indicated that their lack of implementation was due to job changes that results in instruction of different grade levels (other than fifth grade, the target audience for Project FOR.E.S.T.).

It is difficult to say that these results as a whole should have an effect on unit development or implementation. In fact, the lack of any negative commentary on the content or usability of Project FOR.E.S.T. may actually provide justification for its format. The barriers that were reported are mostly those related to timing or school-policy issues. Again, future studies should more fully consider being sensitive to teacher time considerations as well as state and district standards and benchmarks.

SUMMARY AND RECOMMENDATIONS

Project FOR.E.S.T. was created to increase knowledge of forest-related issues in Wisconsin. In developing Project FOR.E.S.T., the researcher was cognizant of recommendations from previous research. Therefore, Project FOR.E.S.T. was formatted as a small-scale, locally-focused, in-service unit. This format proved effective in increasing student knowledge and positive attitudes about forests and forestry. It also proved effective in increasing teacher knowledge about these local issues, and their willingness to incorporate lessons about such.

Though this study made no comparisons between types of subjects taught or methodology of instruction, the results do provide strong justification for use of this
particular methodology suggested in the research literature. Future researchers may wish to conduct similarly planned studies, yet compare units dealing with local topics to units dealing with more general environmental topics. Future studies might also more directly compare in-service instruction of a unit to simple dissemination of the written form of the unit.

Those involved in environmental education programming should consider the results of this study when developing and disseminating environmental education materials. An environmental education curriculum such as this one can only be effective if it is utilized. By instructing this unit in classroom as a method for dissemination, Project FOR.E.S.T. directly helped the students involved and will likely affect future students, as teachers showed willingness to continue forest and forestry instruction in their classroom. Planning for material dissemination should not be neglected, and in fact should be integral to the development and planning process of EE materials. This study (along with previous research) suggests that the method of dissemination influences the materials’ use. If time and funding allow, other environmental educators may wish to adopt similar in-service strategies for development and dissemination of their materials.

Teacher willingness to continue use of Project FOR.E.S.T. and other forestry lessons was reportedly due, in part, to having the lessons demonstrated in their classroom. In developing Project FOR.E.S.T., great care was taken to hire and train competent classroom assistants to effectively instruct the lessons. The trained specialists were a key component in bringing Project FOR.E.S.T. to schools and,
according to survey results, in encouraging continued use of the lessons. Therefore this is a recommended strategy for material dissemination.

In-service training, however, is more expensive and time-consuming than simple distribution of materials without accompanying instruction. The researcher suggests that the benefits of training may justify the additional time and expense (as indicated by this study). Therefore, it may be important for those developing EE materials to consider dissemination strategies early in the development process, especially when securing funding. For instance, grant applications could include discussions of the effectiveness of in-service training (based on examples such as Project FOR.E.S.T.), making material training an integral part of the proposal.
REFERENCES


Wisconsin Department of Natural Resources. (1996). *Defining sustainable forestry. Sustainable Forestry: Commitment to the Future.* Madison, WI: Wisconsin Department of Natural Resources.

Wisconsin Department of Natural Resources. (1999). *Wisconsin’s Millennium Tree.* Madison, WI: Wisconsin Department of Natural Resources.
Wisconsin Department of Natural Resources. Basic Facts About Wisconsin’s Forests.

Available at

http://www.dnr.state.wi.us/org/land/forestry/Look/faqaboutforests.asp.

APPENDIX A

Project FOR.E.S.T. conceptual framework
Fifth Grade Forestry and Forest Ecology Knowledge Assessment Outline

A. Forest composition
   1. Biological communities
      a. Trees
      b. Animals
      c. Understory plants
   2. Abiotic factors
      a. Soil
      b. Water
      c. Sun

B. Forest use/management
   1. Usage
      a. Human use of the forest for recreation ("Social Goals")
      b. Ecological importance of forests ("Environmental Goals")
      c. Human use of forest resources with economic importance ("Economic Goals")
   2. Sustainable Forest Management ("Sustainable Forestry")
      a. The Forester’s Job
      b. Role of DNR in forestry
      c. Non-sustainable practices

C. Tree biology
   1. Functions of wood
      a. Heartwood
      b. Sapwood
   2. Functions of Bark
      a. Cambium
      b. Phloem
   3. Functions of Leaves
   4. Functions of Roots
      a. Taproot
      b. Fibrous roots
      c. Root hairs

D. Forest Products
   1. Food
   2. Wood
   3. Paper
   4. Other
   5. Examples of products from various tree parts
      a. Bark
      b. Trunk
      c. Leaves/Sap

E. Forest Conservation
   1. Sustainable Forestry (see above)
   2. Actions for conservation
      a. Recycling
      b. Reusing
      c. Reducing
APPENDIX B

Project FOR.E.S.T. goals and objectives
Project FOR.E.S.T.: Goals and Objectives

GOAL:
The 5th grade unit entitled Project FOR.E.S.T. (FORestry Education for Students and Teachers) will use a three-lesson unit of forest-based activities to increase students’ knowledge of forestry and forest ecology. This increase in knowledge will provide the basis for appreciation of forests and sustainable forest practices and encourage action. The unit will also expose teachers, many of who may not have previous interest or training in forestry, to the values of forestry environmental education and encourage incorporation into classroom curriculum.

OBJECTIVES:
After participation in all three lessons in the Project FOR.E.S.T. unit, 5th grade students will be able to:

1. Draw a picture of a forest and describe the components of their picture.
2. Identify and explain the three components of sustainable forest management: economic, social, and environmental.
3. Describe a forest as containing not only trees, but also animals, other plants, and non-living elements.
4. Describe how in delicate forest environments, economic and social concerns may be limited.
5. Identify forests as an important part of Wisconsin’s economy.
6. Define “sustainable forest management”.
7. Recognize the biological functions of heartwood/sapwood, phloem, leaves, and roots.

8. Observe trees and, if possible, forests in an outdoor setting.

9. Identify 3 products that come from the forest.

10. Identify trees as a renewable resource.

11. Recommend a personal action for conserving forest resources.

12. State their personal attitudes towards forest conservation.

13. State their personal attitudes in regards to the importance of recycling, reducing, and reusing waste.

The following objectives are for the additional two lessons provided as a resource for the teachers. These lessons will not be taught by Classroom Assistants, and no pre-/posttest questions will address these objectives:

14. Measure and calculate the circumference, diameter, height, and crown-spread of a tree in their schoolyard.

15. Identify one reason a forester might have to obtain measurement information about a tree or stand of trees.

16. Verbally explain the need for consistency in measuring.

17. Verbally list the main ideas of *The Lorax* when read aloud to the class.

18. Discuss with peers and answer in writing questions that concern sustainability and environmental ethics issues related to *The Lorax*, incorporating knowledge from previous lessons.

19. Verbally state and explain answers to specific questions about *The Lorax* (see Lesson 5).
20. Identify a reasonable alternative to the actions taken by the "Once-ler" and evaluate the possible consequences of this action.
APPENDIX C

Suggested guidelines for panel review of Project FOR.E.S.T. lessons
November 21, 2001

Dear [Panel Member],

Thanks so much for your help on this. Attached is a 5-day lesson plan for an introductory forestry unit for 5th grade. The last 2 lessons are meant as an additional resource for teachers who may desire to incorporate them in future classrooms. The first three lessons, though, are the ones that will be taught in the classrooms by UW-SP EE Specialists, and are meant to stand alone.

Please review the lesson plan and evaluate it on its appropriateness for the 5th grade audience. You may write directly on the lesson if you wish. Also, please comment as to whether it contains sufficient background information/instruction for the teacher who would potentially incorporate the unit after having observed the first three lessons instructed this first year. Any other comments or suggestions would also be appreciated. Lessons should each fit in a 50-minute period. The “Evaluations” will not be conducted by the EE Specialists, and are provided as a resource for teachers.

Finally, I have also enclosed special 8th grade WI state standard forms. For each of the first 3 lessons, please rate the activity based on how well it addresses each of the science, social studies, and environmental education standards.

Again, thank you for your help and please contact me with any comments or questions.

Regards,

Mike Kerkman
Graduate Student
College of Natural Resources
University of Wisconsin-Stevens Point
Stevens Point, WI 54481
715-295-0837
mkerk320@uwsp.edu
APPENDIX D

Final version of Project FOR.E.S.T.
Lesson One: What is a Forest?

**Activities utilized:** “Picture a Forest” from Wisconsin Forests Forever

**Materials:** Drawing paper—one piece for every group of 2-3 people; pencils/crayons/markers for the groups to share; tape to hang pictures; copies of Student Page 89 (from Wisconsin Forests Forever)—one for each student; definition cards for Sustainable Forestry (“Balancing all of the forest values for today and the future”), Renewable Resource (“A natural resource that can be replenished”), and Natural Resource (“An object in the environment that humans use for their needs”).

**Corresponding Objectives:**

21. Draw a picture of a forest and describe the components of their picture.
22. Identify and explain the three components of sustainable forest management: economic, social, and environmental values.
23. Describe a forest as containing not only trees, but also animals, other plants, and non-living elements.
24. Describe how in delicate environments, economic and social concerns may be limited.
25. Identify forests as an important part of Wisconsin’s economy.
26. Define “sustainable forest management”.

**8th Grade Standards Fully or Partially Addressed:**

a. Science-A.8.1; F.8.10
b. Social Studies-A.8.8; A.8.11
c. Environmental Education-B.8.5; B.8.9; B.8.12; B.8.15; D.8.5

**Doing the Activity:**

1. Ask each student to think about what they see in their minds when they hear the word “forest”. “The first thing I’d like everybody to do is all close your eyes. Now, think about what you see in your mind when I say the word forest. Picture a
forest in your mind. Don’t answer aloud yet, but what kinds of things do you see? Do you see living things? Do you see things that aren’t living? Do you see people? Just picture what you see as a forest.”

2. The class should get into groups of 2 to 3 people. The teacher can decide on the most effective way to create the groups. Ask each group to share amongst group members the things they see when they think of a forest. Together, each group should draw one picture of a forest. The picture can be a bird’s eye view of the whole forest, or it may be a particular scene. Hand out paper or allow one member to get materials as the group is talking. “Now, together with your group, talk about what you saw in your forest. After you have each shared, begin to draw what you saw. Your forest should have things in it from what each group member saw when we pictured the forest in our minds.” Allow around 10 minutes for this assignment. Collect the drawing materials when students are finished. Hang up the drawing so students can see all examples.

3. Once all the pictures are on display, ask the class to look at them and to notice how they are all very different scenes, though we all started with the same idea (same description). Then point out, though, that there are many similarities too, and that there are important things that make up and define forests. “That is what we will be talking about today, about ‘forest values’” (Write “forest values” on the board). Now ask the class for assistance in defining the word “value”. (Ideas will often include cost, worth, importance.) Highlight that forest values are important parts of the forest, what makes a forest. Forest values are also all the things we depend on forests for.

4. Next, invite student groups to share their pictures with the class and tell what is happening in their forests. In this way, the class can start generating some forest values. “Who would like to share their picture? Tell us about your forest.” As the students list important parts of their forests, add these things to the list under “forest values”. During this time, the teacher should help the class compare and contrast the pictures. Every group will not have time to share, so after a few groups have shared, begin to focus the discussion on categories of forest use (as follows):
5. Ask the class to help add to the list of things that the forest is valued for. The class can add things that were in their picture, but also begin to add things that might not have been explicit in the drawings. Guide the brainstorming session by asking questions at intervals, such as “How do animals value the forest? What are important things we get from trees and the forest? What important jobs depend on the forest? What important activities can we do in the forest?” Write all answers in the list that was started on the board.

6. After there is a good list of forest values, have the class look at all the many things the forest is important for. State that the forest is an important natural resource that has many values. Use the word card to define natural resource (“An object in the environment that humans use for their needs”). Next, talk about how forests and trees are a special natural resource because they are a renewable resource. Ask what it means to be renewable. A good comparison is to talk about how the students can renew their library books, but what would happen if they didn’t? Would other people be able to read the books? Define renewable resource with the word card (“A natural resource that can be replenished”).

7. Now tell the class “Let’s look back at or list of values for this renewable resource. Next we are going to put these values into categories, to see how forests are used, how they are important”. Pass out student page 89, but don’t have the students fill anything out yet. “In the circles, there are three categories of values. Lets look first at the Environmental Values. This would mean the values that are important to the environment, and the things that live in the environment.” Write the words Environmental Values on the board and draw a tree symbol next to it. “Now look at our list: if you see an animal or plant that lives in the forest environment, or, if you see things that are provided for those animals and plants...that is an environmental value. Let me know and I will put our tree symbol next to it”. Have the student spick out the items on the class list that are Environmental Values and draw the tree symbol next to them. Now have the class color in the circle for Environmental Values. “Choose one color and color the whole circle that says Environmental Values. Color the whole circle; you will have to cross
over the lines of the other circles. While you are doing this, can you think of other examples of Environmental Values?”

8. Next, discuss social values. “Who knows what the word ‘social’ might mean? What do you study in social studies?” (Should come up with something about having to do with studies of people.) “For today, we will talk about social values meaning the way people use the forest for recreation, for fun.” Write the word up on the board with a stick figure symbol. Ask the students to identify which values are social and draw the stick figure next to those values. “Now color that circle with a different color. You will color over some parts of the first circle. Can anybody think of any other Social Values?”

9. Finally, discuss the Economic Values. “What does the word ‘economy’ mean?” (This might be difficult, but help the class define it as having to do with jobs, business, and money generated from products and services.). Write the words on the board, symbolized with a dollar sign. “Which of these items are Economic Values?” Draw the dollar sign next to those that they identify. “Now color in the final circle with a different color. While you are doing this, think of any other Economic Values?”

10. Now, look closely at the circles. Point out the areas of overlap, the center of the diagram. “What are the words there?” Just like how all the colors overlap, with sustainable forestry, we can combine the uses of many forests. Through careful planning, often one forest can do many things—the things in all our categories of forest values. Because trees in the forest are renewable (they can be replaced when they are used), we can mange the forest so that if we use them wisely, the resource will remain for future generations. “When we consider all the values of a forest, and think about the best ways to make use of these values and still keep the forest healthy, it is called sustainable forestry.” Post the word card (“Balancing all of the forest values for today and the future”). What might ‘sustainable’ mean?” (Sustainable means that forests are kept in existence, not destroyed. To sustain also means to keep doing something). “And forestry is the job of looking after a forest and making decisions about it—So sustainable forestry means ‘to keep taking care of the forest”.

Assessment: Each student can be asked to write the definition of sustainable forestry, which would be evaluated based on inclusion of all the components. Alternatively, each student could be asked to draw a new picture, this one representing sustainable forestry.

Lesson 2: Exploring Trees

Activities utilized: “Blind Walk”/“Meet a Tree” from Sharing Nature with Children; “Build A Tree” from Sharing Nature with Children II; “Tree Factory” from Project Learning Tree (Reprinted with permission, American Forest Foundation. Copyright 1993. Project Learning Tree Environmental Education Pre K-8 Activity Guide. The complete activity guide can be obtained by attending a PLT workshop. For more information call the National PLT office at 202/463-2462 or the Wisconsin PLT office at 608/264-6280.)

Materials: one blindfold for every two children; outdoor space; tree part word cards (“sapwood”, “heartwood”, “phloem”, “lateral roots”, “bark”, “taproots”); tree “cookies”; approximately 15 carpet scraps if ground is wet or snowy; ‘Tree Factory’ overhead for alternative activity plans.

Corresponding Objectives:

27. Recognize the biological functions of heartwood/sapwood, phloem, leaves, roots, bark.

28. Observe trees and, if possible, forests in an outdoor setting.

8th Grade Standards Fully or Partially Addressed:

a. Science-A.8.1; A.8.6; F.8.1; F.8.2

b. Environmental Education-A.8.3; A.8.5

Doing the Activity:

(Note: If the class is unable to go outside due to weather, the class will instead follow the lesson plans, but use tree “cookies” for the blindfold exploration instead of live trees. This alternate plan can also be used if the school grounds lack trees that can be used in the first awareness activity. Additionally, if time constraints are a problem because students will have to move in and out of doors, then the blindfold walk activity
can be eliminated and the tree factory can be extended. In this case the attached overhead ['Tree Factory'] can be used to do a review after the class comes back indoors. In this way, the lesson should fit shorter time frames.)

1. (It might be best to conduct the introduction and describe the directions about the blindfold walk indoors before going outside.) Review the five senses with the class. Talk about how today we will see what we can discover when we focus only on touch, hearing, and smell. The class will explore trees without sight (and without taste, to be safe!). Go over the directions for the activity, ask a volunteer to help demonstrate. Explain that one student will be blindfolded. The other student will become the “guide”. The guide will lead the partner to a tree that the guide finds interesting. It is important to tell the groups that as a guide, they must be very careful with their partner, walk very slowly, and beware of low branches and obstructions on the ground. The best way to lead the blindfolded person is by holding on to both of his/her shoulders. The blindfolded student will use their senses to explore the tree, and when they are done will be led back to the center, the blindfold will be removed, and the student will see if he/she can find the tree. The partners then switch.

2. Begin this activity by gathering in a circle by a tree outside. Group students into pairs. If there is an extra student, the teacher can participate as well. The class will try to use senses to explore trees.

3. Review the instructions again and pass out the blindfolds. The teacher can walk amongst partners and offer exploring suggestions. Joseph Cornell suggests, “I find that specific suggestions are best. For example, if you tell children to ‘Feel the tree,’ they won’t respond with as much interest as if you say ‘Rub your cheek on the bark.’ Instead of ‘explore your tree,’ be specific: ‘Is this tree alive?...Can you put your arms around it? ...Is the tree older than you are?...Can you find plants growing on it?’ Etc”

4. When they have finished, the guide leads them back to a central location (and possibly by a different route) and the blindfold is removed. The student must now locate the tree that was explored. If there is difficulty, the guide can play “warmer and colder”. (NOTE: If the school grounds lack sufficient trees to have each pair
explore one tree, groups of three could be used. Alternatively, the class could work in pairs, but explore one or two trees that are available, and each person could offer an account of what they sensed about this tree during the exploration.)

5. The partners now switch roles and repeat the activity.

6. Now have a short discussion on how the class members recognized their trees. Ask, “What was unique about your tree?” “What did you like about your tree?” “What did it feel like?” “What did you notice that you might not have if you had been using your sense of sight?” The teacher can eventually bring about the next activity with leading questions such as “What kinds of things did you feel on your tree? (“Bark”) What things did you hear (“Wind in leaves”)? What did it smell like? …Well now we are going to explore what these parts of trees do, how the trees live and eat and grow”.

7. This activity has students act out the various parts of the tree: the tap- and lateral roots, the heartwood and sapwood, the leaves, the phloem, and the bark. Since class sizes vary, the Classroom Assistant will have to judge how many people to use for each part. (NOTE: For each tree part, use a neighboring tree and/or wood “cookie” to point out the feature. Additionally, have word cards for each part so that the students can have a visual, especially for difficult words like “phloem”). The activity involves some students sitting on the ground, and so may need to take place on concrete or inside if there is snow present or use carpet scraps if available.

8. If time permits, begin by asking the students to think about what a tree needs to survive. (“water, food, sunlight, soil, leaves, etc.”) Since a tree can’t move like we can, how does it get these things? How does it protect itself? How does it stay upright in strong winds? It is OK if the class doesn’t have the answers to all these questions because “that is what we are going to learn about now as we work together to build a tree factory”.

9. To begin play, choose volunteers for heartwood. Ask for students that can look strong. Have them stand with their backs to each other. Tell the rest of the group “This is the heartwood (hold up the word card), the inner core, the strength of the tree. The heartwood’s job is to hold the trunk and branches upright, so the leaves
can get their share of the sun.” Point out heartwood on the “cookie”. Tell the volunteers that their job is to stand tall and strong. Ask them to demonstrate their mime of “tall and strong” and to shout “I support!”.

10. Next, ask several people to play the taproot. Ask the class what the roots do (get water) and what kind of sound they might make. Pick out students making great sounds. Tell them to sit down at the base of the heartwood, facing outward. Tell them: “You are a very long root, called a taproot (hold up the word card). Plant yourself deep in the ground—about 30 feet. The taproot enables the tree to get water from deep in the earth, and also anchors the tree firmly to the ground. When storms come, the taproot keeps the tree from being blown over by high winds.” Be sure to say that not all trees have a taproot (e.g., redwoods) but that this one does. The students can demonstrate their job with a big “slurp” sound. Ask them to try.

11. Now ask for more slurpers. These people will become the lateral roots. Ask the lateral roots to lie on their backs with their feet up against the trunk and their bodies extending away from the tree. Tell them “You are the lateral roots. There are hundreds and hundreds of you. You grow outward all around the tree, like branches, but underground. You also help hold the tree upright. At your tips are tiny root hairs (point to a volunteers hair as an example). The lateral roots with their root hairs spread all throughout the soil they grow in (ask the students to show how they spread out the lateral roots and root hairs (with hands or their own hair). When the roots and root hairs sense that there is water nearby, the cells grow toward it and suck it up”. Have these students also demonstrate their slurping.

12. Ask now for volunteers to play the sapwood. Choose enough people to form a complete circle around the heartwood. Have them circle the heartwood, facing inward and holding hands, being careful not to step on any roots! Tell them: “You are the part of the tree called the sapwood (hold up the word cards). You draw water up from the roots and lift it to the tree’s highest branches. You are the most efficient pump in the world. You are able to lift hundreds of gallons of water a day, and you do this at speeds of over 100 miles an hour! After the roots slurp the
water from the ground, your job is to bring the water up the tree. When I say ‘Bring the water up’ you go like this ‘Whoosh!’ (As they do this, they throw their arms up into the air.)” Show the students the sapwood on the tree cookie.

13. Select a group to play the phloem. Have them form a circle around the sapwood, also facing inward and holding hands. Tell them: “Outside of the sapwood, and the innermost part of the bark is called the ‘phloem’ (display the word card and attempt to show phloem on the cookie). Way up in the leaves the tree is making its own food. Sunlight provides the energy for the tree to make sugars, which it uses for food. The phloem is what carries that food to the parts of the tree that need it. When I say ‘Transport the food’ you can get the food from the leaves and pass imaginary food back and forth throughout the tree.” Have the students demonstrate how they would grab the food and pass it all around. The students can shout “feed the tree” for their sound effect.

14. Ask the remaining people to play the bark. Have them circle round the tree, facing outward. Tell them “You are the bark (hold up this last word card). You protect the tree. What kind of dangers do you protect the tree from?” Suggest fire, insects, extreme temperature changes, and people with pocketknives. Show bark on the cookie and on a real tree. Tell the bark how they protect the tree: “When I say ‘Time to protect!’ Raise your arms like a football blocker with both elbows out and both fists close to the chest.” The students can say, “Keep out!”

15. Finally, it is time to function as a whole unit, a full tree. While you are going around the tree, lead the tree groups in their parts. Shout the commands for all the parts in sequence. The commands for the tree parts are as follows: “Heartwood, stand tall and strong!” and “Get tough, Bark!”; “Roots, get the water!”; “Sapwood, bring the water up!”; “Phloem, pass out the food!” After the second round, just shout out the commands without giving the names of the tree parts. When you finish, have the players give themselves a big hand for being such a wonderful tree. To conclude, discuss that as a class we have demonstrated how a tree, without moving, gets water and food (it even makes it’s own food!), and how it converts this into energy to grow, like we do. The class also saw how a tree supports and protects itself, since it cannot move. Word cards can be used to
review the parts. Look at the trees around you outside and point out that even though they look calm, all those busy things are happening right now.

**Assessment:** Students can write an interview with a tree, being asked to incorporate descriptions of ways it can be identified and also the descriptions and functions of the parts that were discussed in class. Teachers can evaluate based on the inclusion and correct understanding of the tree biology. Using the “tree factory overhead” (attached) the teacher could also do an oral review once the class is back indoors.

Lesson 3: All of this from TREES?

**Activities utilized:** “Tree Treasures” from Project Learning Tree. *(Reprinted with permission, American Forest Foundation. Copyright 1993. Project Learning Tree Environmental Education Pre K-8 Activity Guide. The complete activity guide can be obtained by attending a PLT workshop. For more information call the National PLT office at 202/463-2462 or the Wisconsin PLT office at 608/264-6280.)*

**Materials:** Assortment of pictures cut from magazines of products made all or in part from forest resources. Tree products supply trunk (includes other forest products such as toothpaste/toothbrush, rubber, syrup, gum, tissues, vanilla-flavored items, newspapers, etc. See attached list for examples); Copies of PLT page 38 for assessment, one copy for each student; Word cards saying, “Food”, “Wood”, “Paper”; Tape.

**Corresponding Objectives:**

29. Identify 3 products that come from the forest.
30. Identify trees as a renewable resource.
31. Recommend a personal action for conserving forest resources.
32. State their personal attitudes towards forest conservation.
33. State their personal attitudes in regards to the importance of recycling, reducing, and reusing waste.

**8th Grade Standards Fully or Partially Addressed:**

a. Science-C.8.1; E.8.1; F.8.9; F.8.10;
b. Social Studies-D.8.2; D.8.13, D.8.11
Doing the Activity:

1. Start with a brainstorming session. Ask students to name as many products that come from trees as they can think of, and list them on the chalkboard. After a few minutes, look back over the list. Which products do students use every day? Which are made totally from trees? Which partially?

2. Tell the students that they are going to be “tree-tectives”. Each student will gather clues about a “mystery tree product” and try to figure out what it is. When students know what it is, they need to decide which category the product belongs in: food, wood, or paper. Write these categories at three different spots on the board and post the word cards in 3 different areas around the room.

3. Assign each person a mystery product by taping a tree-product picture to each student’s back. (Have several students help you to speed up this step). Tell students they must figure out the identity of the product on their back by asking each other questions. They can ask each person only two questions, and the questions must require a “yes” or “no” answer. For example, “Is this product used in our school?” To make it more interesting, they cannot ask questions that would reveal their category, i.e., “Is it made from wood? Is it used for food?” etc.

4. Give students time to mingle and ask questions. When they think they have identified their product, they should decide which category (wood, paper, food) it belongs to and go to the section of the room designated for that category.

5. Now have each student reveal what he or she thinks their product is, and then to turn around to have it removed from their back. If a student is not correct, simply say “This time you were actually a ____. Which category would this belong in?” Each student should tell why they fit into the category they are standing in. Write the products on the board. Discuss how some products could fit into more than one category. Allow student to change groups as they see fit. When possible, talk about what part of the tree the product comes from.
6. Afterwards, revisit the list of tree products the group brainstormed earlier. Have the class identify categories each student belongs in. See if students can name other products that come from trees.

7. Now bring out the Tree Product Box (see attached list for examples). Begin with some of the items that easily fit into one of the three categories. Talk about which part of the tree provides the product. Volunteers help the products get placed into the proper categories.

8. Next, talk about unusual tree products. Show the class the other items in the box. Ask for volunteers to identify the product you hold up. “Does anybody know how this product is made from trees?” Ask what part of the tree provides parts of these products. Ask them to name some categories that these might belong to.

9. Now look at the huge list of products we get from trees. Ask the class if they think that many of these products are necessary for our lives. Ask the students which of the values (from the first day) we have focused on today (“economic”). Ask what other values this must be balanced with. What is it called when all the values are balanced and considered? This is one way to conserve forests for the future. “But what can each of use do to help preserve forests for our needs today and in the future?” (Students might offer up one of the “three R’s”).

10. “Each one of us can help by using forest products wisely. We can reduce the unnecessary use of forest products. How could we do this? (For example, we can buy products that use small amounts of packaging. Write this under “reduce”). We can also re-use forest products. What products could we re-use? How? (We could use the backsides of our pictures for another art project. Write this under “reuse”). Also, we can recycle our products. Which products can we recycle? (For example, we can recycle these pictures when we don’t want them anymore. Write this under “recycle”). Even when we can recycle, we save energy and resources if we reduce and reuse first” Also explain that some forests are often too delicate to use for forest products. Yet many, many forests can be used to produce products for human, and when managed wisely, they can continue to do this for future generations.
Assessment: Using page 38 from Project Learning Tree, conduct a survey of forest products found in the classroom. Divide students into small groups. Each group should have at least two products in each of the following categories: paper products, school supplies, building materials, furniture, personal items. After the groups have finished, individuals should return to their seats and then provide one item (each) that can be reduced, reused, or recycled. The teacher can grade the assignment based on proper understanding of the products that are made with forest resources and how they can be conserved.

Lesson 4: Trees Measure Up! (NOTE: This lesson may take more than 50 minutes. Additionally, mathematics components will need to be assessed in regards to the appropriateness to the ability level of an individual class.)

Activities utilized: “How Big is Your Tree” from Project Learning Tree. (Reprinted with permission, American Forest Foundation. Copyright 1993. Project Learning Tree Environmental Education Pre K-8 Activity Guide. The complete activity guide can be obtained by attending a PLT workshop. For more information call the National PLT office at 202/463-2462 or the Wisconsin PLT office at 608/264-6280.)

Materials: One ruler for every 2 students; meter sticks (one per pair if possible); flexible tape measures to share or string; calculators (if desired); scratch paper, one copy of the attached worksheet for each student.

Corresponding Objectives:
17. Measure and calculate the circumference, diameter, height, and crown-spread of a tree in their schoolyard.
18. Identify one reason a forester might have to obtain measurement information about a tree or stand of trees.
19. Verbally explain the need for consistency in measuring.

Doing the Activity:
1. Introduction: Foresters (refer to Lesson for the discussion of the job of the forester) measure trees to plan harvesting and to make other forest management decisions.
To determine the approximate timber yield of a stand of trees, foresters do a "timber cruise" in which they calculate the volume of lumber in a given area, examine the health of the forest, and survey the species found there. This information is used to determine how the forest should be cared for and what the economic feasibility of a harvest should be. Volume of wood can be measured in board feet (a piece of lumber 12 inches square [77 sq cm] and 1 inch [2.5cm] thick), cords (a stack of logs 4 ft x 4 ft x 8 ft or 1.2m x 1.2m x 2.4m), cubic feet or cubic meters. One giant Sequoia could yield more than 500,000 board feet. That’s enough to make 33 houses!

2. Take students outside to a location where there are different-sized trees to study. Briefly tell the students about a time you measured an object to find out something (for example, measuring a window to learn how much curtain fabric you needed to buy). Ask them to think of a time when they have measured something. Have them think about what they measured, how they measured it, why they measured it, and what they learned from measuring it. As a class, come up with some general statements about why people measure things. In what ways do they measure?

3. Ask students why a person might want to measure a tree. After students have suggested their ideas, you may share how and why foresters measure trees (see #1).

4. Explain to the students that people in early times used their own bodies (hand spans, for instance) to measure things. Divide the students into pairs or small groups, and ask them to have each group member measure the circumference of two different trees using their hand/foot spans (or arm spans if the tree is large). More than one group can measure the same tree. Have them record these findings on the worksheet.

5. Talk with the students about the accuracy of this type of measurement. For example, “When Eric measure this tree, he found it to be 8 hand spans around, but when Maria measured it, she found it to be 7. Why did Eric and Maria get different measurements?” Ask the students how they can be sure the measurement
of their trees is consistent (use the same person or use a standard measure like a ruler, measure at the same spot).

6. Now have the students re-measure the same trees with standardized measurements. First, have students measure the circumference using the flexible tape measure or a piece of string that they then measure with the ruler. They can record their answers on the worksheet. Now have them compare the data from different groups or persons for the same trees. How consistent are the data? Have students compare this measurement method to the first. If the data is still not fully consistent for the same tree, ask the students to think about why that might be (measuring at different levels.) Now discuss the reasons that consistency and standardization is needed in measuring. In this way, you can communicate your findings to someone else, and they would be able to know that they would have gotten the same results if they had done the measurements.

7. Have the students explore the differences in diameter at 1 foot, 2 feet, and 4 feet from the base of the same tree. Foresters always measure the diameter of a tree at 4.5 feet (1.4 meters) about the ground. This measurement is called “Diameter at Breast Height” or DBH. Could you easily compare the size of two trees if one was measured to be 5 feet in circumference at 1 foot, and the other was 3 feet at 6 feet? Explain that foresters created DBH as their measurement standard, or “ruler”.

8. Show students what is meant by the tree’s crown spread (the distance the tree’s branches spread away from its trunk). Ask students to estimate the tree’s crown spread in feet or meters. Help students measure and calculate the average crown spread by having one student stand under the branch tip farthest from the trunk (Person A) and another under a branch tip opposite that one (Person B). (See illustration) Measure the distance from Person A to Person B. Then, have one student stand under the branch tip closest to the trunk (Person C) and another under the branch tip opposite that one (Person D). Measure the distance for Person C to Person D. Calculate the average of the two measurements. Record this number on the worksheet. Why would the measurement of a tree’s crown be important? (The bigger the crown, the more leaves it had, the more food it can make, and the bigger it can grow).
9. Have students determine the height of the tree by using ratios and multiplication. (See illustration). Have one student stand at the base of a tree. Have another student hold a ruler at arm’s length and walk backward, keeping arm stiff, until the top and bottom of the ruler line up with the top and bottom of the tree. Note where the top of the partner’s head appears on the ruler (for example, at 2” of 5 cm). Divide the length of the ruler (12” or 30 cm) by this figure. For example, $12\div 2 = 6$” or $30 \div 5 = 6$ cm. Record these figures on the worksheet. Measure the partner’s actual height and multiply it by the previous result (i.e., 6). For example, if the student’s height was 55” or 1.4 m, then the height of the tree would be $55 \times 6 = 330”$ (27.5 feet) or $1.4 \times 6 = 8.4$ m. Records answers on the worksheet.

Ask students to compare their calculations. What might explain any differences? (This is a chance to review the idea of consistency.)

10. Review the class’ findings. Highlight the importance in standardizing measurements. Today’s foresters use many similar techniques as the class used today to estimate the amount of lumber in a tree or stand of trees. Why might it be good to know this figures before harvesting any trees?

**Assessment:** Evaluate the students’ understanding by having them demonstrate or write a paragraph or draw a diagram describing the steps that they would take to measure a particular tree. Have them explain how this information might be used and how they can be sure that any person would be able to obtain similar measurements on the same tree. Additionally, students can create a mathematics word problem that relates to measuring a tree. They can then exchange and solve these math problems.

Evaluation should be based on inclusion of appropriate techniques and understanding of consistency and standard measurement.

Lesson 5: Trees for Many Reasons (or “Speaking of Trees…”) (NOTE: This lesson may also take more than 50 minutes)

**Activities utilized:** “Trees for Many Reasons” from Project Learning Tree. (Reprinted with permission, American Forest Foundation. Copyright 1993. Project Learning Tree Environmental
Materials: One copy of *The Lorax* by Dr. Seuss; file cards with one discussion question on each. The video of *The Lorax* may also be used.

Corresponding Objectives:

20. Verbally list the main ideas of a story read aloud to the class.

21. Discuss with peers and answer in writing questions that concern sustainability and environmental ethics issues related to *The Lorax*, incorporating knowledge from previous lessons.

22. Verbally state and explain answers to specific questions about *The Lorax* (see Lesson 5).

23. Identify a reasonable alternative to the actions taken by the “Once-ler” and evaluate the possible consequences of this action.

Doing the Activity:

1. Read *The Lorax* aloud or watch the video that is also available.

2. Ask students to list what they think the major ideas of the story are.

3. Dived the class into 6 groups. Give each group a card with one of the following questions written on it. Each group should discuss their question set. Tell the students that group members may have different answers, and that are not right or wrong answers to these questions. Ask the group to discuss their answers with each other. The group will decide together on the answer(s) to the questions. Groups should write down the answer or answers that the group has discussed and be prepared to read and discuss them with the rest of the class.

4. Questions:
   - How could the Once-ler have managed his company to protect natural resources and not run out of trees to manufacture Thneeds? What could be done for the animals?
• What did the Once-ler mean by “UNLESS”? What responsibility does he seem to think “someone like you” needs to take? What could you (as a buyer of Thneeds) have done to try to prevent the destruction of all the Truffula trees?

• Why did the Once-ler keep making Thneeds? How could he have made more Thneeds without permanently destroying the Truffula forest? What kinds of things can we do today to ensure that trees will be available for all different purposes in the future?

• The young Once-ler explains his actions by saying, “If I didn’t do it, someone else would”. Is this a good excuse for doing what he did? Compare the Once-ler’s attitude toward the environment at the beginning of the story with his attitude at the end.

• The Lorax says he speaks for the trees. What does this mean to you? What is the Lorax’s attitude at the end of the story?

• What seems to be Dr. Seuss’s purpose in writing this fable? (A fable is a fictional story that teaches a lesson.)

5. After groups have had time for discussion, have each group read their questions and answers to the class. Students can agree, disagree, or add to the answers given by their classmates.

**Assessment:** After the discussion, random questions from the whole class can be assigned to each individual student to answer. The answers can be used to assess student understanding of the environmental message contained in the story.
References

Wisconsin Forests Forever is published and copyrighted by the Wisconsin Forest Resources Education Alliance (WFREA: www.wfrea.org). It is available for purchase through WFREA or through attending a training workshop. Used by permission of WFREA.

Project Learning Tree: Reprinted with permission, American Forest Foundation.
The complete activity guide can be obtained by attending a PLT workshop. For more information call the National PLT office at 202/463-2462 or the Wisconsin PLT office at 608/264-6280.

Sharing Nature with Children and Sharing Nature with Children II both by Joseph Cornell. Copyright Dawn Publications PO Box 2010 Nevada City, CA 95959. Tel: 530-478-0111. Fax: 530-478-0112. Used by permission of the publisher.
Picture the Forest

Social Values

Economic Values

Sustainable Forestry

Environmental (Ecological) Values
forms the central core of the tree, is made up of dense dead wood, and provides strength for the tree.

also called the xylem (ZEYE-uhm), brings water and nutrients up from the roots to the leaves; older xylem cells become part of the heartwood.

 Cambium (KAM-bee-uhm), a very thin layer of growing tissue, makes cells that become new xylem, phloem, or cambium.

also called the inner bark, carries sap (sugar and nutrients dissolved in water) from the leaves to the rest of the tree; at certain times of the year, may also transport stored sugars from the roots up to the rest of the tree (for example, in the springtime, the sap of sugar maples rises from the roots and is tapped by people to make maple syrup).

protects the tree from injury caused by insects and other animals, by other plants, by disease, and by fire; characteristics vary from species to species (for example, it may be thin, thick, spongy, rough, smooth, covered with spines, and so on, depending on the type of tree).
Day 3 Forest Product Box Contents

box of matches............................. wood
sponge........................................ cellulose, found in the walls of cells
maple syrup...................................... sap from the sugar maple tree
dental kit:
   toothbrush................................. bristles are made from cellulose
toothpaste................................. contains cellulose
   Scope.......................................... contains resins (secreted by trees) that have antiseptic properties (help fight germs).
Erasers........................................... rubber is sap/latex from a rubber tree and other tropical plants.
Gum............................................... gum base is made with rosin, which is in sap.
Frosting.......................................... artificial vanilla flavoring comes from the lignosulfates that are left over after making paper. (Real vanilla comes from the vanilla orchid).
Crayons........................................... carnauba wax from the carnauba palm
Toilet paper.................................................. paper product (paper is mostly cellulose)
Aspirin.................................................. originally from willow bark
Trees Measure Up!

Tree Height

Crown Spread
Trees Measure Up!

In this activity we will be determining the circumference, height, and crown spread of a few trees at our school. We will do this measuring with and without tools.

The **circumference** is the distance around the trunk of your tree. Measure the circumference using just yourself. You may decide to use your hands, arms, even feet! For example, one student found a tree that was 8 lengths of her hand around. Record your own findings for two different trees below.

This is how I measured Tree #1:

__________________________________________

Its **circumference** is __________________________________________________

This is how I measured Tree #2:

__________________________________________

Its **circumference** is __________________________________________________

Now you will measure the same trees, but this time using rulers or measuring tapes. Record your answers below.

Tree #1 has a **circumference** of ____________ inches.
Tree #2 has a **circumference** of ____________ inches.

The **crown spread** is the distance the tree’s branches spread away from the trunk. Have one person stand under the branch tip *farthest* from the trunk of your tree. Have another person stand under the tip opposite of them. Measure the distance between these two people.

A. What is this distance? ________________________________

Now have one person stand under the branch tip *closest* to the trunk, and another person opposite them. Measure the distance between these two people.

B. What is this distance? ________________________________
You can use these two numbers to find the **average crown spread** for your tree.

Add the two distances together. \( \text{A. } + \text{B. } = \) 

Divide this last sum by 2 to get the average crown spread. 

To measure the **height** of your tree you can use a special formula and the heights of students in your class.

Have one person in your group stand at the base of your tree. Hold a ruler at arm’s length away from you and walk backward (be careful!) keeping your arm stiff. Walk backward until the top and bottom of the ruler line up with the top and bottom of the tree. Now, look where the top of your partner’s head is on the ruler. Record the number that matches the top of your partner’s head on the ruler.

A. ____________ marks my partner’s height on the ruler.

Divide the length of the ruler (usually 12 inches) by this number. For example:

12 inches : \( \text{Answer from A} = ? \)

B. ________________ is my answer from this calculation.

Measure the actual height of your partner.

C. ________________ is how tall my partner is.

Now multiply your answer C and B.

A. ______________ x B. ______________ = ______________, the estimated height of our tree.
APPENDIX E

Forms used in correlating Project FOR.E.S.T. lessons with Wisconsin state academic standards for science, social studies, and environmental education
### Wisconsin's Model Academic Standards for Science 8th Grade

<table>
<thead>
<tr>
<th>Science8thGradeStandardNum</th>
<th>Standard Text</th>
<th>Fully</th>
<th>Partially</th>
<th>Not at All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science-A</td>
<td>Science Connections Content Standards: Students in Wisconsin will understand that there are unifying themes: systems, order, organization, and interactions; evidence, models, and explanations; constancy, change, and measurement; evolution, equilibrium, and energy; form and function among scientific disciplines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-A.8.1</td>
<td>Develop their understanding of the science themes by using the themes to frame questions about science-related issues and problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-A.8.2</td>
<td>Describe limitations of science systems and give reasons why specific science themes are included in or excluded from those systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-A.8.3</td>
<td>Defend explanations and models by collecting and organizing evidence that supports them and critique explanations and models by collecting and organizing evidence that conflicts with them</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-A.8.4</td>
<td>Collect evidence to show that models developed as explanations for events were (and are) based on the evidence available to scientists at the time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-A.8.5</td>
<td>Show how models and explanations, based on systems, were changed as new evidence accumulated (the effects of constancy, evolution, change, and measurement should all be part of these explanations)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-A.8.6</td>
<td>Use models and explanations to predict actions and events in the natural world</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B</td>
<td>Nature of Science Content Standards: Students in Wisconsin will understand that science is ongoing and inventive, and that scientific understandings have changed over time as new evidence is found</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B.8.1</td>
<td>Describe how scientific knowledge and concepts have changed over time in the earth and space, life and environmental, and physical sciences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B.8.2</td>
<td>Identify and describe major changes that have occurred over in conceptual models and explanations in the earth and space, life and environmental, and physical sciences and identify the people, cultures, and conditions that led to these developments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B.8.3</td>
<td>Explain* how the general rules of science apply to the development and use of evidence* in science investigations, model*-making, and applications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B.8.4</td>
<td>Describe types of reasoning and evidence used outside of science to draw conclusions about the natural world</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B.8.5</td>
<td>Explain ways in which science knowledge is shared, checked, and extended, and show how these processes change over time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-B.8.6</td>
<td>Explain the ways in which scientific knowledge is useful and also limited when applied to social issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C</td>
<td>Science Inquiry Content Standards: Students in Wisconsin will investigate questions using scientific methods and tools, revise their personal understanding to accommodate knowledge, and communicate these understandings to others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.1</td>
<td>Identify questions they can investigate using resources and equipment they have available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-8thGradeStandardNum</td>
<td>Standard Text</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Science-C.8.2</td>
<td>Identify data and locate sources of information including their own records to answer the questions being investigated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.3</td>
<td>Design and safely conduct investigations that provide reliable quantitative or qualitative data, as appropriate, to answer their questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.4</td>
<td>Use inferences to help decide possible results of their investigations, use observations to check their inferences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.5</td>
<td>Use accepted scientific knowledge, models, and theories to explain their results and to raise further questions about their investigations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.6</td>
<td>State what they have learned from investigations, relating their inferences to scientific knowledge and to data they have collected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.7</td>
<td>Explain their data and conclusions in ways that allow an audience to understand the questions they selected for investigation and the answers they have developed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.8</td>
<td>Use computer software and other technologies to organize, process, and present their data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.9</td>
<td>Evaluate, explain, and defend the validity of questions, hypotheses, and conclusions to their investigations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.10</td>
<td>Discuss the importance of their results and implications of their work with peers, teachers, and other adults</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-C.8.11</td>
<td>Raise further questions which still need to be answered</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D</td>
<td>Physical Science Content Standards: Students in Wisconsin will demonstrate an understanding of the physical and chemical properties of matter, the forms and properties of energy, and the ways in which matter and energy interact</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.1</td>
<td>Observe, describe, and measure physical and chemical properties of elements and other substances to identify and group them according to properties such as density, melting points, boiling points, conductivity, magnetic attraction, solubility, and reactions to common physical and chemical tests</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.2</td>
<td>Use the major ideas of atomic theory and molecular theory to describe physical and chemical interactions among substances, including solids, liquids, and gases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.3</td>
<td>Understand how chemical interactions and behaviors lead to new substances with different properties</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.4</td>
<td>While conducting investigations, use the science themes to develop explanations of physical and chemical interactions and energy exchanges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.5</td>
<td>While conducting investigations, explain the motion of objects by describing the forces acting on them</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.6</td>
<td>While conducting investigations, explain the motion of objects using concepts of speed, velocity, acceleration, friction, momentum, and changes over time, among others, and apply these concepts and explanations to real-life situations outside the classroom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.7</td>
<td>While conducting investigations* of common physical and chemical interactions* occurring in the laboratory and the outside world, use commonly accepted definitions of energy* and the idea of energy conservation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Num</td>
<td>Standard Text</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Science-D.8.8</td>
<td>Describe and investigate the properties of light, heat, gravity, radio waves, magnetic fields, electrical fields, and sound waves as they interact with material objects in common situations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.9</td>
<td>Explain the behaviors of various forms of energy by using the models of energy transmission, both in the laboratory and in real-life situations in the outside world</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-D.8.10</td>
<td>Explain how models of the atomic structure of matter have changed over time, including historical models and modern atomic theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E</td>
<td>Earth and Space Science Content Standards: Students in Wisconsin will demonstrate an understanding of the structure and systems of earth and other bodies in the universe and of their interactions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.1</td>
<td>Using the science themes, explain and predict changes in major features of land, water, and atmospheric systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.2</td>
<td>Describe underlying structures of the earth that cause changes in the earth's surface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.3</td>
<td>Using the science themes during the process of investigation, describe climate, weather, ocean currents, soil movements and changes in the forces acting on the earth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.4</td>
<td>Using the science themes, analyze the influence living organisms have had on the earth's systems, including their impact on the composition of the atmosphere and the weathering of rocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.5</td>
<td>Analyze the geologic and life history of the earth, including change over time, using various forms of scientific evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.6</td>
<td>Describe through investigations the use of the earth's resources by humans in both past and current cultures, particularly how changes in the resources used for the past 100 years are the basis for efforts to conserve and recycle renewable and non-renewable resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.7</td>
<td>Describe the general structure of the solar system, galaxies, and the universe, explaining the nature of the evidence used to develop current models of the universe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-E.8.8</td>
<td>Using past and current models of the structure of the solar system, explain the daily, monthly, yearly, and long-term cycles of the earth, citing evidence gained from personal observation as well as evidence used by scientists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F</td>
<td>Life and Environmental Science Content Standards: Students in Wisconsin will demonstrate an understanding of the characteristics and structures of living things, the processes of life, and how living things interact with one another and their environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.1</td>
<td>Understand the structure and function of cells, organs, tissues, organ systems, and whole organisms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.2</td>
<td>Show how organisms have adapted structures to match their functions, providing means of encouraging individual and group survival within specific environments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.3</td>
<td>Differentiate between single-celled and multiple-celled organisms (humans) through investigation, comparing the cell functions of specialized cells for each type of organism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.4</td>
<td>Investigate and explain that heredity is comprised of the characteristic traits found in genes within the cell of an organism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Num</td>
<td>Standard Text</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Science-F.8.5</td>
<td>Show how different structures both reproduce and pass on characteristics of their group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.6</td>
<td>Understand that an organism is regulated both internally and externally</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.7</td>
<td>Understand that an organism’s behavior evolves through adaptation to its environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.8</td>
<td>Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.9</td>
<td>Explain how some of the changes on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-F.8.10</td>
<td>Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G</td>
<td>Science Applications Content Standards: Students in Wisconsin will demonstrate an understanding of the relationship between science and technology and the ways in which that relationship influences human activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.1</td>
<td>Identify and investigate the skills people need for a career in science or technology and identify the academic courses that a person pursuing such a career would need</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.2</td>
<td>Explain how current scientific and technological discoveries have an influence on the work people do and how some of these discoveries also lead to new careers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.3</td>
<td>Illustrate the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.4</td>
<td>Propose a design (or re-design) of an applied science model or a machine that will have an impact in the community or elsewhere in the world and show how the design (or re-design) might work, including potential side-effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.5</td>
<td>Investigate a specific local problem to which there has been a scientific or technological solution, including proposals for alternative courses of action, the choices that were made, reasons for the choices, any new problems created, and subsequent community satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.6</td>
<td>Use current texts, encyclopedias, source books, computers, experts, the popular press, or other relevant sources to identify examples of how scientific discoveries have resulted in new technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-G.8.7</td>
<td>Show evidence of how science and technology are interdependent, using some examples drawn from personally conducted investigations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-H</td>
<td>Science in Social and Personal Perspectives Content Standards: Students in Wisconsin will use scientific information and skills to make decisions about themselves, Wisconsin, and the world in which they live</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-H.8.1</td>
<td>Evaluate the scientific evidence used in various media (for example, television, radio, Internet, popular press, and scientific journals) to address a social issue, using criteria of accuracy, logic, bias, relevance of data, and credibility of sources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science8thGradeStandardNum</td>
<td>StandardText</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Science-H.8.2</td>
<td>Present a scientific solution to a problem involving the earth and space, life and environmental, or physical sciences and participate in a consensus-building discussion to arrive at a group decision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science-H.8.3</td>
<td>Understand the consequences of decisions affecting personal health and safety</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Wisconsin's Model Academic Standards for Social Studies 8th Grade

<table>
<thead>
<tr>
<th>SocStud8thGradeStandardNum</th>
<th>Standard Text</th>
<th>Fully</th>
<th>Partially</th>
<th>Not at All</th>
</tr>
</thead>
<tbody>
<tr>
<td>SocStud-A</td>
<td>Geography Content Standards: Students in Wisconsin will learn about geography through the study of the relationships among people, places, and environments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.1</td>
<td>Use a variety of geographic representations, such as political, physical, and topographic maps, a globe, aerial photographs, and satellite images, to gather and compare information about a place</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.2</td>
<td>Construct mental maps of selected locales, regions, states, and countries and draw maps from memory, representing relative location, direction, size, and shape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.3</td>
<td>Use an atlas to estimate distance, calculate scale, identify dominant patterns of climate and land use, and compute population density</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.4</td>
<td>Conduct a historical study to analyze the use of the local environment in a Wisconsin community and to explain the effect of this use on the environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.5</td>
<td>Identify and compare the natural resource bases of different states and regions in the United States and elsewhere in the world, using a statistical atlas, aerial photographs, satellite images, and computer databases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.6</td>
<td>Describe and distinguish between the environmental effects on the earth of short-term physical changes, such as those caused by floods, droughts, and snowstorms, and long-term physical changes, such as those caused by plate tectonics, erosion, and glaciation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.7</td>
<td>Describe the movement of people, ideas, diseases, and products throughout the world</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.8</td>
<td>Describe and analyze the ways in which people in different regions of the world interact with their physical environments through vocational and recreational activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.9</td>
<td>Describe how buildings and their decoration reflect cultural values and ideas, providing examples such as cave paintings, pyramids, sacred cities, castles, and cathedrals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.10</td>
<td>Identify major discoveries in science and technology and describe their social and economic effects on the physical and human environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-A.8.11</td>
<td>Give examples of the causes and consequences of current global issues, such as the expansion of global markets, the urbanization of the developing world, the consumption of natural resources, and the extinction of species, and suggest possible responses by various individuals, groups, and nations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B</td>
<td>History Content Standards: Students in Wisconsin will learn about the history of Wisconsin, the United States, and the world, examining change and continuity over time in order to develop historical perspective, explain historical relationships, and analyze issues that affect the present and the future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.1</td>
<td>Interpret the past using a variety of sources, such as biographies, diaries, journals, artifacts, eyewitness interviews, and other primary source materials, and evaluate the credibility of sources used</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.2</td>
<td>Employ cause-and-effect arguments to demonstrate how significant events have influenced the past and the present in United States and world history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.3</td>
<td>Describe the relationships between and among significant events, such as the causes and consequences of wars in United States and world history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.4</td>
<td>Explain how and why events may be interpreted differently depending upon the perspectives of participants, witnesses, reporters, and historians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.5</td>
<td>Use historical evidence to determine and support a position about important political values, such as freedom, democracy, equality, or justice, and express the position coherently</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.6</td>
<td>Analyze important political values such as freedom, democracy, equality, and justice embodied in documents such as the Declaration of Independence, the United States Constitution, and the Bill of Rights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.7</td>
<td>Identify significant events and people in the major eras of United States and world history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.8</td>
<td>Identify major scientific discoveries and technological innovations and describe their social and economic effects on society</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.9</td>
<td>Explain the need for laws and policies to regulate science and technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.10</td>
<td>Analyze examples of conflict, cooperation, and interdependence among groups, societies, or nations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.11</td>
<td>Summarize major issues associated with the history, culture, tribal sovereignty, and current status of the American Indian tribes and bands in Wisconsin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-B.8.12</td>
<td>Describe how history can be organized and analyzed using various criteria to group people and events chronologically, geographically, thematically, topically, and by issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C</td>
<td>Political Science and Citizenship Content Standards: Students in Wisconsin will learn about political science and acquire the knowledge of political systems necessary for developing individual civic responsibility by studying the history and contemporary uses of power, authority, and governance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.1</td>
<td>Identify and explain democracy's basic principles, including individual rights, responsibility for the common good, equal opportunity, equal protection of the laws, freedom of speech, justice, and majority rule with protection for minority rights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.2</td>
<td>Identify, cite, and discuss important political documents, such as the Constitution, the Bill of Rights, and landmark decisions of the Supreme Court, and explain their function in the American political system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.3</td>
<td>Explain how laws are developed, how the purposes of government are established, and how the powers of government are acquired, maintained, justified, and sometimes abused</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.4</td>
<td>Describe and explain how the federal system separates the powers of federal, state, and local governments in the United States, and how legislative, executive, and judicial powers are balanced at the federal level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.5</td>
<td>Explain how the federal system and the separation of powers in the Constitution work to sustain both majority rule and minority rights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.6</td>
<td>Explain the role of political parties and interest groups in American politics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud8thGradeStandardNum</td>
<td>StandardText</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>SocStud-C.8.7</td>
<td>Locate, organize, and use relevant information to understand an issue of public concern, take a position, and advocate the position in a debate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.8</td>
<td>Identify ways in which advocates participate in public policy debates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-C.8.9</td>
<td>Describe the role of international organizations such as military alliances and trade associations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D</td>
<td>Economics Content Standards: Students in Wisconsin will learn about production, distribution, exchange, and consumption so that they can make informed economic decisions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.1</td>
<td>Describe and explain how money makes it easier to trade, borrow, save, invest, and compare the value of goods and services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.2</td>
<td>Identify and explain basic economic concepts: supply, demand, production, exchange, and consumption; labor, wages, and capital; inflation and deflation; market economy and command economy; public and private goods and services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.3</td>
<td>Describe Wisconsin's role in national and global economies and give examples of local economic activity in national and global markets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.4</td>
<td>Describe how investments in human and physical capital, including new technology, affect standard of living and quality of life</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.5</td>
<td>Give examples to show how government provides for national defense; health, safety, and environmental protection; defense of property rights; and the maintenance of free and fair market activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.6</td>
<td>Identify and explain various points of view concerning economic issues, such as taxation, unemployment, inflation, the national debt, and distribution of income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.7</td>
<td>Identify the location of concentrations of selected natural resources and describe how their acquisition and distribution generates trade and shapes economic patterns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.8</td>
<td>Explain how and why people who start new businesses take risks to provide goods and services, considering profits as an incentive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.9</td>
<td>Explain why the earning power of workers depends on their productivity and the market value of what they produce</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.10</td>
<td>Identify the economic roles of institutions such as corporations and businesses, banks, labor unions, and the Federal Reserve System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-D.8.11</td>
<td>Describe how personal decisions can have a global impact on issues such as trade agreements, recycling, and conserving the environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E</td>
<td>Behavioral Sciences Content Standards: Students in Wisconsin will learn about the behavioral sciences by exploring concepts from the discipline of sociology, the study of the interactions among individuals, groups, and institutions; the discipline of psychology, the study of factors that influence individual identity and learning; and the discipline of anthropology, the study of cultures in various times and settings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.1</td>
<td>Give examples to explain and illustrate the influence of prior knowledge, motivation, capabilities, personal interests, and other factors on individual learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.2</td>
<td>Give examples to explain and illustrate how factors such as family, gender, and socioeconomic status contribute to individual identity and development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud8thGradeStandardNum</td>
<td>Standard Text</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>SocStud-E.8.3</td>
<td>Describe the ways in which local, regional, and ethnic cultures may influence the everyday lives of people</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.4</td>
<td>Describe and explain the means by which individuals, groups, and institutions may contribute to social continuity and change within a community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.5</td>
<td>Describe and explain the means by which groups and institutions meet the needs of individuals and societies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.6</td>
<td>Describe and explain the influence of status, ethnic origin, race, gender, and age on the interactions of individuals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.7</td>
<td>Identify and explain examples of bias, prejudice, and stereotyping, and how they contribute to conflict in a society</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.8</td>
<td>Give examples to show how the media may influence the behavior and decision-making of individuals and groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.9</td>
<td>Give examples of the cultural contributions of racial and ethnic groups in Wisconsin, the United States, and the world</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.10</td>
<td>Explain how language, art, music, beliefs, and other components of culture can further global understanding or cause misunderstanding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.11</td>
<td>Explain how beliefs and practices, such as ownership of property or status at birth, may lead to conflict among people of different regions or cultures and give examples of such conflicts that have and have not been resolved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.12</td>
<td>Describe conflict resolution and peer mediation strategies used in resolving differences and disputes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.13</td>
<td>Select examples of artistic expressions from several different cultures for the purpose of comparing and contrasting the beliefs expressed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SocStud-E.8.14</td>
<td>Describe cooperation and interdependence among individuals, groups, and nations, such as helping others in times of crisis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Wisconsin’s Model Academic Standards for EE 8th Grade

<table>
<thead>
<tr>
<th>EE 8th Grade Standard Num</th>
<th>Standard Text</th>
<th>Fully</th>
<th>Partially</th>
<th>Not at All</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE-A</td>
<td>Questioning and Analysis Content Standards: Students in Wisconsin will use credible research methods to investigate environmental questions, revise their personal understanding to accommodate new knowledge and perspectives, and be able to communicate this understanding to others.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-A.8.1</td>
<td>Identify education issue questions that can be investigated using resources and equipment available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-A.8.2</td>
<td>Collect information from a variety of resources, conduct experiments, and develop possible solutions to their investigations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-A.8.3</td>
<td>Use techniques such as modeling and simulating to organize information gathered in their investigations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-A.8.4</td>
<td>Use critical thinking strategies to interpret and analyze gathered information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-A.8.5</td>
<td>Use the results of their investigations to develop answers, revise their personal understanding, and draw conclusions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-A.8.6</td>
<td>Communicate the results of investigations using a variety of media and logically defend their answers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B</td>
<td>Knowledge of Environmental Processes and Systems Content Standards: Students in Wisconsin will demonstrate and understanding of the natural environment and the interrelationships among natural systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.1</td>
<td>Describe the flow of energy in a natural and a human-built ecosystem using the laws of thermodynamics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.2</td>
<td>Explain how change is a natural process, citing examples of succession, evolution, and extinction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.3</td>
<td>Explain the importance of biodiversity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.4</td>
<td>Map the levels of organization of matter, e.g., subatomic particles through biomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.5</td>
<td>Give examples of human impact on various ecosystems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.6</td>
<td>Describe major ecosystems of Wisconsin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.7</td>
<td>Illustrate the conservation of matter using biogeochemical cycles; e.g., carbon, nitrogen, phosphorus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.8</td>
<td>Explain interactions among organisms or populations of organisms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.9</td>
<td>Explain how the environment is perceived differently by various cultures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.10</td>
<td>Explain and cite examples of how humans shape the environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.11</td>
<td>Describe our society as an ecosystem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.12</td>
<td>Provide examples of how different cultures use natural resources, reflecting the economic, aesthetic, and other values of that culture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.13</td>
<td>Diagram how resources are distributed around the world</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.14</td>
<td>Identify the natural resources that are found in Wisconsin and those that are imported</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.15</td>
<td>Analyze how people impact their environment through resource use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.16</td>
<td>Recognize the economic, environmental, and other factors that impact resource availability and explain why certain resources are becoming depleted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.17</td>
<td>Explain how human resource use can impact the environment; e.g., erosion, burning fossil fuels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE8thGradeStandardNum</td>
<td>Standard Text</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------</td>
<td>-------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>EE-B.8.18</td>
<td>Identify major air, water, or land pollutants and their source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.19</td>
<td>Distinguish between point and nonpoint source pollution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.20</td>
<td>Identify types of waste and methods for waste reduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.21</td>
<td>Identify and analyze individual, local, regional, national, and global effects of pollution on plant, animal, and human health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.22</td>
<td>Identify careers related to natural resources and environmental concerns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.23</td>
<td>Identify governmental and private agencies responsible for environmental protection and natural resource management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-B.8.24</td>
<td>Create a timeline of Wisconsin history in resource management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-C</td>
<td>Environmental Issue Investigation Skills Content Standards: Students in Wisconsin will be able to identify, investigate, and evaluate environmental problems and issues.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-C.8.1</td>
<td>Define and provide examples of environmental issues, explaining the role of beliefs, attitudes, and values</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-C.8.2</td>
<td>Use environmental monitoring techniques such as observations, chemical analysis, and computer mapping software to collect data about environmental problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-C.8.3</td>
<td>Use questioning and analysis skills to determine beliefs, attitudes, and values held by people involved in an environmental issue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-C.8.4</td>
<td>Evaluate the credibility of information, recognizing social, economic, political, environmental, technological, and educational influences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D</td>
<td>Decision and Action Skills Content Standards: Students in Wisconsin will use findings from environmental issue investigations to develop decision-making skills, and to gain experience in citizen action skills.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.1</td>
<td>Identify options for addressing an environmental issue and evaluate the consequences of each option</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.2</td>
<td>List the advantages and disadvantages of short-term and long-term solutions to an environmental issue or problem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.3</td>
<td>List reasons why an individual or group chooses to participate or not participate in an environmental activity in the home, school, or community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.4</td>
<td>Explain political, legal, and budgetary options for resolving local, state, and national environmental issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.5</td>
<td>Explain how their personal actions can impact an environmental issue; e.g., doing work in conservation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.6</td>
<td>Develop a plan for improving or maintaining some part of the local environment and identify their role in accomplishing this plan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.7</td>
<td>Identify examples of how personal beliefs can influence environmental decisions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-D.8.8</td>
<td>Give examples of education, economic, and government institutions influence on an environmental issue, and the role of citizens in policy formation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-E</td>
<td>Personal and Civic Responsibility Content Standards: Students in Wisconsin will develop an understanding and commitment to environmental stewardship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE8thGradeStandardNum</td>
<td>Standard Text</td>
<td>Fully</td>
<td>Partially</td>
<td>Not at All</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>EE-E.8.1</td>
<td>Formulate a personal plan for environmental stewardship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE-E.8.2</td>
<td>Explain the importance of characteristics (such as trust, patience, self-discipline, respect, and open-mindedness) that enable people to function together to resolve environmental issues</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

Letter to district Curriculum Coordinators requesting permission to teach Project FOR.E.S.T.
Dear Educator:

The University of Wisconsin-Stevens Point and Golden Sands Resource Conservation and Development Council have recently developed a forestry environmental education unit that we would like to introduce to the fifth grade classrooms of your district.

The program is entitled Project FOR.E.S.T. (FORestry Education for Students and Teachers).

Project FOR.E.S.T.

- is a three-lesson (each lesson 50 minutes) unit that teaches students about the value of Wisconsin’s forests as a renewable natural resource.
- includes important discussion of tree biology and forest products, and introduces students to the notion of sustainable forest management.
- addresses in its lessons many of the Wisconsin State Science and Environmental Education Standards for 8th grade.
- provides teachers with a valuable resource to incorporate into their yearly fifth grade curriculum.
- is provided free to your schools by the Wisconsin Environmental Education Board.

UWSP and Golden Sands RC&D intend to bring the unit into the school systems of Central Wisconsin through direct visits to the classrooms. Trained Forestry EE Specialists will spend three approximately fifty-minute sessions in each classroom teaching the full unit. Instruction will be available starting in January 2002 through spring, and be available again in the fall.

The participating classrooms in your district will benefit from having a valuable unit taught to the students and demonstrated to the teachers. The unit was created so that teachers could continue its instruction each year. Additional resources will be provided to teachers so that the unit can be expanded if so desired.

The unit does include a short pre- and post-unit evaluation exercise used for our research purposes. Students, schools, teachers and districts will remain anonymous in the evaluation process.

We would appreciate your district’s participation in this exciting program. Please call me at 715-346-2014 or e-mail me at mkerk320@uwsp.edu for more information or to discuss times for instruction. We will work with your schedule to set up times to instruct during a week that is convenient for you. I look forward to speaking with you.

Thank you for your time,

Mike Kerkman
Environmental Education Specialist
(715) 346-2025
mkerk320@uwsp.edu
APPENDIX G

Letters to validity panel members, outlining the process for selection of questions for the pre- and posttest
Questions for Validity Panel [for Graduate Committee and fifth grade teachers]

The enclosed represents a pool of question developed to assess the knowledge and attitudes of 5th graders based on their completion of a 3-lesson forestry education unit. The test eventually developed from these questions will be issued to the students before and after the unit is instructed. The same questions will be used for both tests.

Some questions may assess the same knowledge or attitude. They are included as alternate ways to assess a topic and should each be evaluated separately. In the final draft, the best questions will be selected.

Attached are the goals and objectives of the project. Please use these as a guide to what should be assessed by the test.

Please evaluate each question from the attached based on its validity and appropriateness in testing forestry knowledge and attitudes at a fifth grade level. Please evaluate each item individually. For any “no” answer, please explain how the question might be improved. Any other suggestions/comments should also be included.

Knowledge questions:
Is the content of the question accurate?
Does the question address the learning objective as stated?
Are the correct answers provided the most appropriate?
Are the foils appropriate?
Does the level and complexity of the correct answer match that of the foils?
Does the question have appropriate wording and phrasing based on a 5th grade audience?
Do the answer and foils have appropriate wording and phrasing?
If a forestry term is addressed, is its inclusion appropriate based on completion of an introductory forestry unit?

Attitudinal statements:
Does the statement address an appropriate attitude?
Does the statement reveal bias, or lead the student to answer in a certain manner?

Open-ended questions:
Is the content of the question accurate?
Is the terminology appropriate for 5th graders (at least upon completion of an introductory forestry unit)?

Overall:
Was there an appropriate range of questions to assess the students’ forestry knowledge and attitudes based on the goals and objectives of the project?

Is there an appropriate mix of the levels within Bloom’s Taxonomy-Cognitive Domain (i.e., knowledge, comprehension, application, analysis, synthesis, evaluation)?
Questions for Validity Panel [for Jay Price: Education Professor]

The enclosed represents a pool of question developed to assess the knowledge and attitudes of 5th graders based on their completion of a 3-lesson forestry education unit. The test eventually developed from these questions will be issued to the students before and after the unit is instructed. The same questions will be used for both tests.

Some questions may assess the same knowledge or attitude. They are included as alternate ways to assess a topic and should each be evaluated separately. In the final draft, the best questions will be selected.

Attached are the goals and objectives of the project. Please use these as a guide to what should be assessed by the test.

Dr. Price:
Please evaluate each question from the attached based on its validity and appropriateness in testing forestry knowledge and attitudes of 5th grade level students. Please evaluate each item individually. For any “no” answer, please explain how the question might be improved.

Knowledge questions:
Does the question have appropriate wording and phrasing based on a 5th grade audience?
Do the answer and foils have appropriate wording and phrasing?
Does the question address the learning objective as stated?
If a forestry term is addressed, is its inclusion appropriate based on completion of an introductory forestry unit?
Is the format/phrasing of the question direct and unambiguous?
Does the level and complexity of the correct answer match that of the foils?

Attitudinal statements:
Does the statement address an appropriate attitude?
Does the statement reveal bias, or lead the student to answer in a certain manner?

Open-ended questions:
Is the content of the question accurate?
Is the terminology appropriate for 5th graders (at least upon completion of an introductory forestry unit)?

Overall:
Is there an appropriate mix of the levels within Bloom’s Taxonomy-Cognitive Domain (i.e., knowledge, comprehension, application, analysis, synthesis, evaluation)?

Was there an appropriate range of questions to assess the students’ forestry knowledge and attitudes based on the goals and objectives of the project?
Questions for Validity Panel [for Hans Schabel: Forestry Professor]
The enclosed represents a pool of question developed to assess the knowledge and attitudes of 5th graders based on their completion of a 3-lesson forestry education unit. The test eventually developed from these questions will be issued to the students before and after the unit is instructed. The same questions will be used for both tests. Some questions may assess the same knowledge or attitude. They are included as alternate ways to assess a topic and should each be evaluated separately. In the final draft, the best questions will be selected. Attached are the goals and objectives of the project. Please use these as a guide to what should be assessed by the test.

Dr. Schabel:
Please evaluate each question from the attached based on its validity and appropriateness in testing forestry knowledge and attitudes. Please evaluate each item individually. For any “no” answer, please explain how the question might be improved. Any other suggestions/comments should also be included.

Knowledge questions:
Is the content of the question accurate?
Does the question address the learning objective as stated?
Are the correct answers provided the most appropriate?
Are the foils appropriate?
Does the level and complexity of the correct answer match that of the foils?
Is the terminology appropriate for 5th graders (at least upon completion of an introductory forestry unit)?

Attitudinal statements:
Does the statement address an appropriate attitude?
Does the statement reveal bias, or lead the student to answer in a certain manner?

Open-ended questions:
Is the content of the question accurate?
Is the terminology appropriate for 5th graders (at least upon completion of an introductory forestry unit)?

Overall:
Was there an appropriate range of questions to assess the students’ forestry knowledge and attitudes based on the goals and objectives of the project?
APPENDIX H

Example letter to classroom teachers in regards to administration of the pretest
[Teacher's name],

Here are the pre- and posttests for your classrooms. UWSP’s Institutional Review Board approved the test, and we have your district superintendent’s permission to go ahead with this as well.

Included are all the tests you will need. The pretest and the posttest are the same document. The following is the guidelines for administering the tests:

[Designated class] will be our “control”. This class should complete the pre- and posttest before the first day of instruction. The tests would be about one week apart. Therefore, could you please administer the test the first time on or before November 27th, then administer it the second time (the posttest) on or before December 4th? Then I will teach them on December 5th (when both tests will be complete).

[Designated class] will be the “experimental” group. Please issue them the pretest on or just before December 4th. The posttest will come after the instruction; I will provide more copies for this when I come to your classrooms.

The classes were randomly assigned as “control” and “experimental”.

Have students write FIRST NAMES and LAST INITIALS directly on the test and also on the Scantron.

Directions are included with the exam, but it may help to read them with your classes. Students may have trouble with some words, and you are free to help them with definitions, but please help them realize that it is more of a survey than a test. They will not be graded and it is expected that they might not know all the answers.

I realize this is a lot to ask. I do appreciate your participation.

Please let me know if you have any questions.

Thank you so much,

Mike Kerkman
Environmental Education Specialist
College of Natural Resources
CNR Room 110
University of Wisconsin--Stevens Point
Stevens Point, WI 54481
715-346-2025
APPENDIX I

Project FOR.E.S.T. pre- and posttest (same document)
INSTRUCTIONS

Directions:

Mark your answers on the answer sheet. Use a #2 pencil to darken the circle you choose. Do not make marks outside the circle. To begin, fill in your first name and last initial in the space provided on the answer sheet and fill in the appropriate bubbles.

A correctly filled circle:

\[
\begin{array}{c|c|c|c|c}
T & F \\
1 & \\
2 & \\
\end{array}
\]

Incorrectly filled circles:

\[
\begin{array}{c|c|c|c|c}
T & F \\
1 & 0 & 0 & 0 & 0 \\
2 & 0 & 0 & 0 & 0 \\
\end{array}
\]

Today you are going to take a short survey about what you know and what you feel about forestry. This will not be used for a grade in your class. There are three parts to the survey.

**Part One** asks about what you know. Choose the best answer for each question. Notice that there are four choices: A, B, C, and D.

Practice:

1. Wisconsin is a ________.
   A. continent
   B. country
   C. state
   D. city

2. Which of the following is an insect?
   A. armadillo
   B. giraffe
   C. bat
   D. mosquito
Part Two asks you what you think about some statements. There are five choices. There are no right or wrong answers. An example statement might be: “I spend too much time in school.”

If you strongly agree with the statement...........fill in circle A (strongly agree)
If you agree with the statement......................fill in circle B (agree)
If you neither agree nor disagree......................fill in circle C (neither agree nor disagree)
If you disagree with the statement.....................fill in circle D (disagree)
If you strongly disagree with the statement..........fill in circle E (strongly disagree)

Practice:

1. Spicy foods are better than sweet foods
2. It is important to make my bed every morning

Part Three asks you to write in answers on this answer sheet. You do not need to fill in any blanks on the answer sheet for part three. Fill in as many blanks as you can, if you don’t know an answer or run out of ideas, leave the empty spaces blank.

Example:

In the spaces below, list 6 vegetables

1. carrots 2. celery
3. cabbage 4. broccoli
5. __________ 6. __________
PART ONE

Instructions for Part One: Fill in the circle on your answer sheet for the letter of the answer that is most like your answer to each of the following questions.

1. Managing a forest sustainably means
   A) Protecting a forest from human use, such as logging and snowmobiling
   B) Producing a variety of products from the resources of the forest
   C) Balancing human use with environmental needs of the forest
   D) Harvesting lumber to produce the highest possible number of jobs and money

2. Trees are considered a(n) __________ resource
   A) Renewable
   B) Non-renewable
   C) Recycled
   D) Industrial

3. Saying that a forest can meet economic values means
   A) Forest resources provide products, services, and jobs to humans
   B) Forests help keep our air and water clean
   C) The forest provides habitat many different types of plants and animals
   D) Many non-profit organizations work to conserve forest resources

4. Saying that the forest meets environmental values means
   A) Important products like paper, lumber, and syrup come from forests
   B) A forest is a good environment for humans to use for recreation, such as hiking, skiing, or bird watching
C) Forests provide habitat for many different kinds of plants and animals
 D) Forests provide pleasing places for building homes and businesses

5. The environmental values of a forest may limit economic and social values if
   A) It is too cold for humans to use the forest for its resources.
   B) That forest has endangered plants or animals.
   C) The forest is located in a place where few people live.
   D) It never would limit these other needs.

6. Saying that the forest meets social values means
   A) It is important to talk about forests
   B) The plants and animals in a forest interact with each other
   C) Many industries use forest resources
   D) Forest provide a space for humans to use for recreation.

7. A tree's heartwood
   A) Transports water and minerals
   B) Transports food
   C) Is part of the bark
   D) Mainly supports the trunk and branches

8. A tree's resistance to fire is most likely due to special characteristics in the
   A) Soil
   B) Bark
   C) Roots
   D) Heartwood
9. A tree’s sapwood
   A) Transports water and minerals
   B) Transports food
   C) Is part of the bark
   D) Mainly supports the trunk and branches

10. Food is made in the leaves of trees, and it travels through
    A) Phloem
    B) Cambium
    C) Sapwood
    D) It doesn’t travel, it stays in the leaves

11. A forest is best described as
    A) Trees
    B) Trees and other living and non-living things
    C) Trees and water
    D) Trees and small plants

12. Select the choice that best shows an action that demonstrates the social values of a forest
    A) Charging a fee for a hunting permit
    B) Bird watching
    C) Harvesting wood
    D) Building a paper mill
PART TWO

Instructions for Part Two: These sections is about what you think, about your feelings and opinions. Be honest.

There are no right or wrong answers. Fill in the circle on your answer sheet that is closest to what you think.

Strongly agree agree neither agree nor disagree disagree strongly disagree
(A) (B) (C) (D) (E)

13. I feel that forests are an important part of Wisconsin's economy.

14. I believe that if humans want to use a forest, they should make sure that the next generation of humans would be able to use it in the same way or in an improved condition.

15. I believe that forests will be needed by future generations.

16. I can help conserve forest resources.

17. I feel that it is not important to conserve the use of a product that comes from a renewable resource.

18. I feel that plants like ferns, vines, and shrubs are an important part of a forest.

19. I feel that animals, even tiny ones like worms and insects, are an important part of a forest.

20. I believe that recycling forest products such as wood and paper is important.
PART THREE

Instructions for Part THREE: You do not need to fill in any blanks on the answer sheet for part three. Write you answers in the spaces below on this page. Fill in as many blanks as you can, if you don’t know an answer or run out of ideas, leave the empty spaces blank.

In the space below, list as many products (up to 10) that come from the forest.

1. __________________________ 2. __________________________ 3. __________________________
4. __________________________ 5. __________________________ 6. __________________________
7. __________________________ 8. __________________________ 9. __________________________
10. __________________________

In the space below, list up to three actions an individual can take to conserve forest resources.

1. __________________________
2. __________________________
3. __________________________
APPENDIX J

Teacher consent form
CONSENT FORM

Explanation of Procedures:
Mike Kerkman, Graduate Student at the University of Wisconsin - Stevens Point, is conducting a study to determine the effectiveness of a three-lesson forestry unit for fifth graders, and the willingness of teachers to incorporate such lessons into their curricula. We would appreciate your participation in this study, as it will help us in making recommendations to improve dissemination of, and training for, environmental education materials.

As part of this study, we would like you to complete the attached teacher survey, which will be used to assess the effectiveness and use of the forestry unit.

Additionally, your students are being asked to take a short pre- and post-unit test that will also be used for our assessment purposes. Participation is voluntary. Any student has the right to be excused from any and all questions. Student results will be kept anonymous in any reporting, and no identification or comparison will be made between individual students, schools, or districts.

Alternative Procedures: Personal interviews can be conducted by request.

Risk: We don't believe there is any risk, physical or social, to you by participating in this interview.

Safeguards: The information gathered will be kept completely anonymous. We will not release any information that would identify you.

Freedom to withdraw: If you want to withdraw from the study at any time, you may do so without any penalty. The information on you up to that point would be destroyed.

Offer to answer inquiries: Once the study is completed, we would be glad to give you the results. In the meantime, if you have any questions, please ask us or contact:

Mike Kerkman
Graduate Student
College of Natural Resources
UW-SP
Stevens Point, WI 54481
(715) 346-2025
mkerk320@uwsp.edu

Third party: If you have any complaints about your treatment as a participant in this study, please call or write:
Dr. Sandra Holmes, Chair
Institutional Review Board for the Protection of Human Subjects
Department of Psychology
University of Wisconsin - Stevens Point
Stevens Point, WI 54481
(715) 346-3952

Although Dr. Holmes will ask your name, all complaints are kept in confidence.

I have received a complete explanation of the study and agree to participate.

Name_________________________ Date________________

This research project has been approved by the UWSP Institutional Review Board for the Protection of Human Subjects.
APPENDIX K

District administrator approval form
As District Administrator of __________________ School District, I grant permission for UW-SP representatives to issue, administer, and collect pre- and posttest to coincide with the instruction of a three-lesson forestry education unit. I understand that the Institutional Review Board at UW-SP has approved the tests and classroom participation is voluntary.

Name_________________________________________ Date________________________

Signature_____________________________________________________________________

(please fax to the College of Natural Resources. Attn: Mike Kerkman 715-346-3025)

**Background:**

UW-SP and Golden Sands Resource Conservation and Development Council have developed this three-lesson unit that is being instructed in classrooms by trained UW-SP Environmental Education Specialists. District curriculum coordinators and school principals have approved school participation.

The lessons in the unit deal with topics in sustainable forestry, tree biology, and the forest products industry. Teachers receive instructional materials and the entire program is being offered to schools free of charge. The pre- and posttests are for our own program evaluation purposes only and are voluntary and anonymous.

For questions or more information please contact Mike Kerkman at the address, phone, or e-mail below.

Mike Kerkman
Environmental Education Specialist
College of Natural Resources
CNR Room 110
University of Wisconsin--Stevens Point
Stevens Point, WI 54481
715-346-2025
mkerk320@uwsp.edu
APPENDIX L

Rubric for the grading of test write-in answers
Rubric for Part Three: Write-in Answers

1) In the space below, list as many products as you can (up to 10) that come from the forest.

Guidelines for grading (a total of three points are possible):

1-3 products  one point
4-6 products  two points
7-10 products three points

- Correct answers (counted products) include tree products, animal products, natural resources that could be found in a forest, forest plant products. Items discussed in class will be counted, but in the case of items like “frosting”, only the vanilla flavoring (the forest product) will be counted.

- Spelling errors will not affect scoring, but unidentifiable words will be marked incorrect.

- No crop plants (not grown in forests) will be counted.

- Minerals (from the soil/earth) will be judged individually, but not likely counted as industrial harvesting would not likely occur in a forest.

- Forest animal products that are consumed or used (i.e., fish, deer, fur) will be counted but animals with non-specific uses (i.e., bear, animals) will not be counted.

- Only products will be counted (i.e., not “social values” such as hunting or jobs such as logging).

- “Products” should be restricted to items bought/sold, yet case-by-case judgment may allow for some items (i.e. “shade”). Furthermore, certain raw natural resources (water, trees, etc. will be accepted). “Plants” is too vague, and parts of trees (bark, branches)
will not be counted as products. “Water” will be accepted, but bodies of water (rivers, ponds) will not be counted as products.

- Products should be traditionally or often made from forest products to be counted. For example “houses”, “boats” would count but, for example, “art supplies” is not specific enough.

- Repeat products, such as “pencils” and “colored pencils”, will not be counted as separate answers.

- Because it was part of class discussion, tree products that are not traditionally forest products, such as commercial fruits and nuts, will be counted.

- Only the first ten products will be counted.
2) In the space below, list up to three actions an individual can take to conserve forest resources.

Guidelines for grading (a total of three points are possible):

1 action one point
2 actions two points
3 actions three points

- Correct answers include “reducing”, “reusing”, “recycling”, “replanting”.
- Answers must be more specific conservation actions, i.e., “conserving” or “taking care of the forest” are too vague.
- Any form of “practicing sustainable forestry” will be accepted.
- Forms of “don’t cut down trees”, “don’t kill animals” will be accepted.
- Both “hunt animals” and “don’t hunt animals” will be counted, as cases can be made for each being a form of conservation. The same goes for “don’t clear cut” and “clear cut certain areas”.
- Answers related to political/consumer action (in regards to forest natural resource conservation) will be accepted. This includes answers pointing towards peer/family discussions, etc. These answers must be specific enough that they identify a conservation action. Example:

  Accepted: “Talk to parents about recycling”
  Not accepted: “Talk to parents”
  Accepted: “Write a letter to the newspaper about conserving forests”
  Not accepted: “Write letters”
• Answers highlighting only consumptive economic uses or consumptive social uses will not be accepted.

• Only the first three answers will be counted.
APPENDIX M

Attitudinal section of student pre- and posttest document with optimal responses highlighted
PART TWO

Instructions for Part Two: These section is about what you think, about your feelings and opinions. Be honest.

There are no right or wrong answers. Fill in the circle on your answer sheet that is closest to what you think.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

13. I feel that forests are an important part of Wisconsin’s economy.

14. I believe that if humans want to use a forest, they should make sure that the next generation of humans would be able to use it in the same way or in an improved condition.

15. I believe that forests will be needed by future generations.

16. I can help conserve forest resources.

17. I feel that it is not important to conserve the use of a product that comes from a renewable resource.

18. I feel that plants like ferns, vines, and shrubs are an important part of a forest.

19. I feel that animals, even tiny ones like worms and insects, are an important part of a forest.

20. I believe that recycling forest products such as wood and paper is important.
APPENDIX N

Project FOR.E.S.T. teacher survey
TEACHER SURVEY

Directions:

Mark your answers on the answer sheet. Use a #2 pencil to darken the circle you choose on the Scantron sheet.

Write any comments in the space provided on this sheet.

<table>
<thead>
<tr>
<th>Strongly agree (A)</th>
<th>agree (B)</th>
<th>neither agree nor disagree (C)</th>
<th>disagree (D)</th>
<th>strongly disagree (E)</th>
</tr>
</thead>
</table>

1. I have previously taught about sustainable forestry in my classroom

Yes (A)  

Comments:


2. The time allotted to instructing the lessons was appropriate

Strongly agree (A)  

agree (B)  

neither agree nor disagree (C)  

disagree (D)  

strongly disagree (E)

Comments:


3. The lessons were at an appropriate level for my classroom

Strongly agree (A)  

agree (B)  

neither agree nor disagree (C)  

disagree (D)  

strongly disagree (E)

Comments:


4. I will incorporate these lessons into my classroom curriculum next year

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: __________________________________________

5. I will incorporate other forestry lessons into my classroom curriculum

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: __________________________________________

6. (If intending to use forestry lessons in the future): Having the forestry unit taught in my classroom influenced my decision to use them or similar lessons in my curriculum

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: __________________________________________

7. (If intending to use forestry lessons in the future): Receiving the written materials (without instruction by the EE specialist) would have been enough for me to decide to use the lessons in my classroom.

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: __________________________________________
8. The Environmental Education specialist(s) who visited my classroom were punctual

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: ____________________________________________


9. The Environmental Education specialist(s) who visited my classroom were professional and effective instructors

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: ____________________________________________


10. My students gained valuable information about sustainable forestry and forest-related topics

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: ____________________________________________


11. I gained valuable information about sustainable forestry and forest-related topics

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
</tr>
</tbody>
</table>

Comments: ____________________________________________

12. I gained valuable information about how to teach about sustainable forestry and forest-related topics

<table>
<thead>
<tr>
<th>Strongly agree (A)</th>
<th>agree (B)</th>
<th>neither agree nor disagree (C)</th>
<th>disagree (D)</th>
<th>strongly disagree (E)</th>
</tr>
</thead>
</table>

Comments: 

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Other comments:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
APPENDIX O

Project FOR.E.S.T. teacher re-survey
Dear [Fifth Grade Teacher],

Thank you again for your participation in Project FOR.E.S.T. Your help has been invaluable. Over the course of two semesters we were able to bring sustainable forestry education to over 800 students and their teachers in Central Wisconsin. As we assess the effectiveness of the project, we hope for your input one last time in the form of answers to the following four-question survey. Directions follow, and we hope to collect all responses by February 14th. If the format of the survey is unreadable due to email translations, please email me back to request an alternate format.

Thank you and enjoy the second semester!

Sincerely,
Mike Kerkman
Project FOR.E.S.T.

Directions:
1) Hit "Reply" to respond to this email
2) Mark answers by placing an “X” and a space *in front* of the response chosen
3) You may write comments at any point.
4) "Send" the email when you have marked your responses

1) I have implemented in my classroom at least one of the three Project FOR.E.S.T. lessons taught by UW-SP classroom assistant(s):
   Yes
   If yes, how many?
   1
   2
   3

   No

   (Comments):

2) I have implemented in my classroom at least one of the two *additional* Project FOR.E.S.T. lessons provided in the lesson plans, but not taught in-class by UW-SP classroom assistants (i.e., Lessons Four and Five):
   Yes
   If yes, how many?
   1
   2
   3

   No
3) In my classroom I have implemented other forestry lessons, aside from those found in Project FOR.E.S.T., since receiving in-class instruction from UW-SP Classroom Assistants:
   Yes
   No

4) If you haven't implemented forestry lessons, please briefly describe any barriers to your teaching them, or conversely anything that might encourage you to teach such lessons in the future

Thank you!!
APPENDIX P

Per-item graphical representation of the responses to the Project FOR.E.S.T. teacher survey
Teacher survey item Q1

Bars show counts

Teacher survey item Q2

Bars show counts
Teacher survey item Q4

Bars show counts

Teacher survey item Q5

Bars show counts

q4

q5
Teacher survey item Q6

Teacher survey item Q7
Teacher survey item Q8

Bars show counts

Teacher survey item Q9

Bars show counts
Teacher survey item Q10

Bars show counts

Teacher survey item Q11

Bars show counts
Teacher survey item Q12

Bars show counts

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>28</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
</tr>
<tr>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>Disagree</td>
<td></td>
</tr>
<tr>
<td>Strongly disagree</td>
<td></td>
</tr>
</tbody>
</table>

N=28
APPENDIX Q

Per-item statistical analysis of the results of responses to the Project FOR.E.S.T. teacher survey
<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
<th>Q6</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>45</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>44</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mean</td>
<td>1.78</td>
<td>1.32</td>
<td>1.32</td>
<td>1.89</td>
<td>2.00</td>
<td>1.77</td>
</tr>
<tr>
<td>Median</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.420</td>
<td>.471</td>
<td>.471</td>
<td>.840</td>
<td>.752</td>
<td>.859</td>
</tr>
<tr>
<td>Range</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Q7</th>
<th>Q8</th>
<th>Q9</th>
<th>Q10</th>
<th>Q11</th>
<th>Q12</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>44</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Missing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>3.57</td>
<td>1.06</td>
<td>1.06</td>
<td>1.26</td>
<td>1.43</td>
<td>1.49</td>
</tr>
<tr>
<td>Median</td>
<td>4.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.846</td>
<td>.247</td>
<td>.247</td>
<td>.441</td>
<td>.542</td>
<td>.655</td>
</tr>
<tr>
<td>Range</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Frequency Table**

**Q1**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid yes</td>
<td>10</td>
<td>21.3</td>
<td>22.2</td>
<td>22.2</td>
</tr>
<tr>
<td>no</td>
<td>35</td>
<td>74.5</td>
<td>77.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>95.7</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>2</td>
<td>4.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Q2**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid strongly agree</td>
<td>32</td>
<td>68.1</td>
<td>68.1</td>
<td>68.1</td>
</tr>
<tr>
<td>agree</td>
<td>15</td>
<td>31.9</td>
<td>31.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

**Q3**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid strongly agree</td>
<td>32</td>
<td>68.1</td>
<td>68.1</td>
<td>68.1</td>
</tr>
<tr>
<td>agree</td>
<td>15</td>
<td>31.9</td>
<td>31.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Q4</td>
<td>Frequency</td>
<td>Percent</td>
<td>Valid Percent</td>
<td>Cumulative Percent</td>
</tr>
<tr>
<td>----</td>
<td>-----------</td>
<td>---------</td>
<td>---------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Valid strongly agree</td>
<td>19</td>
<td>40.4</td>
<td>40.4</td>
<td>40.4</td>
</tr>
<tr>
<td>agree</td>
<td>14</td>
<td>29.8</td>
<td>29.8</td>
<td>70.2</td>
</tr>
<tr>
<td>neutral</td>
<td>14</td>
<td>29.8</td>
<td>29.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q5</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid strongly agree</td>
<td>13</td>
<td>27.7</td>
<td>27.7</td>
<td>27.7</td>
</tr>
<tr>
<td>agree</td>
<td>21</td>
<td>44.7</td>
<td>44.7</td>
<td>72.3</td>
</tr>
<tr>
<td>neutral</td>
<td>13</td>
<td>27.7</td>
<td>27.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q6</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid strongly agree</td>
<td>19</td>
<td>40.4</td>
<td>43.2</td>
<td>43.2</td>
</tr>
<tr>
<td>agree</td>
<td>18</td>
<td>38.3</td>
<td>40.9</td>
<td>84.1</td>
</tr>
<tr>
<td>neutral</td>
<td>6</td>
<td>12.8</td>
<td>13.6</td>
<td>97.7</td>
</tr>
<tr>
<td>strongly disagree</td>
<td>1</td>
<td>2.1</td>
<td>2.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>93.6</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>3</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q7</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid agree</td>
<td>6</td>
<td>12.8</td>
<td>13.6</td>
<td>13.6</td>
</tr>
<tr>
<td>neutral</td>
<td>11</td>
<td>23.4</td>
<td>25.0</td>
<td>38.6</td>
</tr>
<tr>
<td>disagree</td>
<td>23</td>
<td>48.9</td>
<td>52.3</td>
<td>90.9</td>
</tr>
<tr>
<td>strongly disagree</td>
<td>4</td>
<td>8.5</td>
<td>9.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>93.6</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>3</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q8</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid strongly agree</td>
<td>44</td>
<td>93.6</td>
<td>93.6</td>
<td>93.6</td>
</tr>
<tr>
<td>agree</td>
<td>3</td>
<td>6.4</td>
<td>6.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Q9</td>
<td>Frequency</td>
<td>Percent</td>
<td>Valid Percent</td>
<td>Cumulative Percent</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>---------</td>
<td>---------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Valid</td>
<td>44</td>
<td>93.6</td>
<td>93.6</td>
<td>93.6</td>
</tr>
<tr>
<td>strongly agree</td>
<td>3</td>
<td>6.4</td>
<td>6.4</td>
<td>100.0</td>
</tr>
<tr>
<td>agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q10</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>35</td>
<td>74.5</td>
<td>74.5</td>
<td>74.5</td>
</tr>
<tr>
<td>strongly agree</td>
<td>12</td>
<td>25.5</td>
<td>25.5</td>
<td>100.0</td>
</tr>
<tr>
<td>agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q11</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>28</td>
<td>59.6</td>
<td>59.6</td>
<td>59.6</td>
</tr>
<tr>
<td>strongly agree</td>
<td>18</td>
<td>38.3</td>
<td>38.3</td>
<td>97.9</td>
</tr>
<tr>
<td>agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>neutral</td>
<td>1</td>
<td>2.1</td>
<td>2.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q12</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>28</td>
<td>59.6</td>
<td>59.6</td>
<td>59.6</td>
</tr>
<tr>
<td>strongly agree</td>
<td>15</td>
<td>31.9</td>
<td>31.9</td>
<td>91.5</td>
</tr>
<tr>
<td>agree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>neutral</td>
<td>4</td>
<td>8.5</td>
<td>8.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>