

### Introduction and Purpose

What do Wisconsin students know, feel, and do about environmental problems and issues? Are Wisconsin schools providing an educational experience that includes development of student environmental literacy? In order to gain insight into these questions and others, an environmental literacy assessment of over 3,500 students was conducted in 1994 by the Wisconsin Center for Environmental Education.

The goal of the student assessments was to provide feedback to Wisconsin educators on the general level of environmental literacy in the statewide population of K-12 students. This information could then be used for improving the quality of environmental education in our schools. The assessment instruments were not developed for the diagnostic evaluation of individuals or to compare individual schools or districts. They were developed to provide an overview of representative populations of students in the state.

### Development of the Assessments

The development of the student environmental literacy assessments involved an extensive three-year research, writing, evaluation and implementation process. Two environmental education specialists from the Wisconsin Center for Environmental Education served as project staff. The assessment project was guided throughout by a statewide advisory council made up of individuals representing elementary and secondary classroom teachers, school administrators, university professors, the Department of Natural Resources, the Department of Public Instruction, the Wisconsin Association for Environmental Education, and the Wisconsin Education Association Council.

The advisory council determined that testing a random sample of the states' fifth and eleventh grade populations would be sufficient to provide an adequate perspective on the degree of student environmental literacy across the state. After an exhaustive review of research related to

environmental literacy assessment, a framework or outline was developed to guide construction of questions to be used in the assessment instruments (i.e., tests). A summary of the framework is presented below with a more detailed version included in Appendix E.

- I. Affective learning outcomes
  - A. environmental sensitivity
  - B. values related to prevention and remediation of environmental problems and issues
- II. Perspectives on environmentally responsible behavior
  - A. locus of control (perception of personal efficacy; do students feel they, as individuals, can have an impact)
  - B. assumption of personal responsibility
- III. Environmentally responsible behaviors
  - A. ecomanagement (i.e., habitat management)
  - B. economic action
  - C. persuasion
  - D. political action
  - E. legal action
- IV. Cognitive learning outcomes
  - A. knowledge of ecological foundations
  - B. knowledge of environmental problems and issues
  - C. knowledge of environmental issue investigation and action strategies

Based on the framework, specific learner objectives (expectations as to what students of these ages should be learning in the schools about the environment) were drafted. Teachers from across the state were employed to review the framework and objectives and to assist in the design of appropriate assessment questions.

After a pool of questions was developed, they were again sent out to educators who evaluated their validity, readability, and overall appropriateness for the given grade level. The test items that survived the educator reviews were then administered in a series of pilot tests to over 250 fifth and eleventh

grade students. Pilots were conducted so that statistical item analysis could be done on each question in the pool (Appendix F).

Test items that were evaluated to be appropriate by educators and showed acceptable item analysis results were then sampled from to develop a draft assessment instrument for each of the two grade levels. These draft instruments were again piloted with over 1,000 students from the fifth and eleventh grades. The analysis and results of these pilots were then used to construct the final instruments that were used in the statewide assessment.

Both the fifth and eleventh grade tests were designed to assess student perspectives relative to the four areas outlined above. Attitudes toward the environment and perspectives on behavior related to environment were surveyed using a Likert scale (strongly agree to strongly disagree, Part Two of Appendices A and B). Student behaviors were assessed by asking students to report frequencies of various citizen or student actions related to the environment, again using a Likert-type scale (Part Three of Appendices A and B). Cognitive knowledge about the environment and associated issues was assessed with multiple choice "best answer" questions (Part Four of Appendices A and B).

The instruments were designed to be administered in a 40 minute period. The total number of items on the fifth grade test was 79 and there were 90 items on the eleventh grade test. Students responded to all items on computer scored answer forms.

During the 1994 school year, 105 school districts were contacted by the project staff and requested to participate in the Wisconsin Environmental Literacy Assessment Project. The districts were randomly selected by the Department of Public Instruction (DPI) based on a desired sample size of 1,500-2,000 Wisconsin students at both the fifth and eleventh grade levels. The resulting sample included 82 classrooms at each grade level totaling 1,854 fifth grade and 1,807 high school students (Table S.1).

A letter was sent to each district administrator explaining the project and requesting his/her support and assistance. All but three districts agreed to participate in the project. Each district was asked to select a predetermined number of "typical" fifth and/or eleventh grade classrooms to participate in the survey. This proportionally predetermined number was provided by a DPI statistician based on the districts' total student population.

The assessment packages were mailed out in February 1994 with instructions to the teachers administering the tests. Teachers were given a period of four weeks to administer the tests and return the completed answer forms to the Wisconsin Center for Environmental Education. In addition to administering the tests, teachers were asked to complete a brief survey requesting basic information about the students taking the test (Appendix G).

Students responding to the assessments were placed into the following groups for analysis of results. All respondents at each of the two grade levels were placed in a group titled the "Total Population" (TP; N= 1,854 fifth grade and 1,807 high school students). "Environmentally Literate" (EL) subpopulations of students were also identified in each of these populations by selecting students who were either self-identified or teacher-identified as being above average in their understanding of environmental concerns (n = 679 fifth grade students and 669 high school students). A third

**Table S.1 1994 Student Environmental Literacy Assessment Sample**

	Fifth Grade	High School	Total
# School Districts	59	62	*102
# Classrooms	82	82	164
# Students (N)	1,854	1,807	3,661

\* Samples from 19 districts included classrooms

group consisted of the students at each grade level who were neither self- nor teacher-identified as environmentally literate. Those subpopulations were titled the “Not Identified” (NI) groups.

## Results

Results of the student environmental literacy assessments are herein presented relative to major response trends that were identified in the four sections of each assessment (i.e. demographic, affective, behavior, and cognitive). In both the fifth and eleventh grade instruments, Part One was established to collect demographic data. Classroom teachers administering the tests were also asked to supply background or demographic information on their school and students. Part Two (the affective subscale) dealt with attitudes, locus of control, and assumption of personal responsibility for environmental quality. Part Three (the behavior subscale) allowed for an actual self reporting of student behaviors related to the environment. Part Four (the cognitive subscale) assessed student awareness and knowledge related to ecology, the environment, and environmental issues and actions.

### Part One: Demographic Results

Demographic results include responses to questions 1-4 on the elementary and questions 1-5 on the secondary instrument. Teachers administering the tests also provided some demographic information on the students in their respective schools (Appendix G).

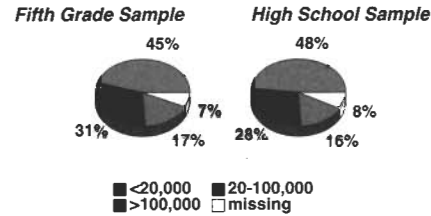
#### *Was the assessment representative of the population of Wisconsin K-12 youth?*

As much as possible, given the random sampling procedures used by the Department of Public Instruction, the state advisory council feels that responses to these assessments are representative of all 5th and 11th grade students in Wisconsin.

**Community Size:** Most of both the fifth grade and high school classrooms participating in the assessment were composed of students from rural or small towns of less than 20,000 people,

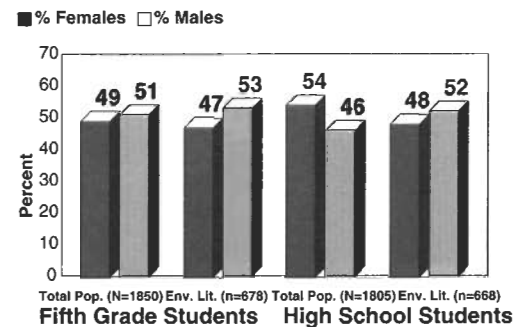
approximately 30 % were from communities of 20,000 to 100,000 and 16 % of both populations of students were from communities of more than 100,000 (Figure S.1).

**Figure S.1: Population Size of Communities Where Sample Classrooms were Located**  
(N = 82 classrooms for each grade level)



**Gender:** Approximately equal numbers of females (49%) and males (51%) completed the fifth grade assessment. The “environmentally literate” group at the fifth grade level was 47% female and 53% male. At the high school level, more females (54%) than males (46%) completed the assessment test, but these percentages were nearly reversed in the identified “environmentally literate” high school group (48% female, 52% male) (Figure S.2).

**Figure S.2: Gender of Students in Sample Populations**

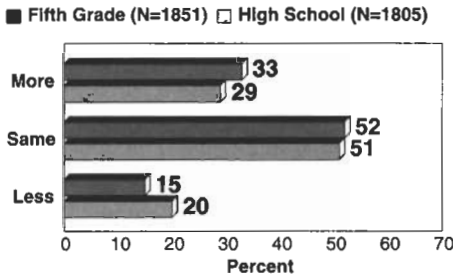


#### *Are students interested in learning about the environment?*

Yes, there seems to be considerable student interest in receiving instruction about the environment. A majority of elementary and high school respondents indicated that education about the environment is of interest to them. Eighty-five percent of the elementary students responded favorably to studying environmental topics. Similarly, eighty percent of high school respondents suggested that studying environmental topics was more interesting

or as interesting as studying other subjects (Figure S.3).

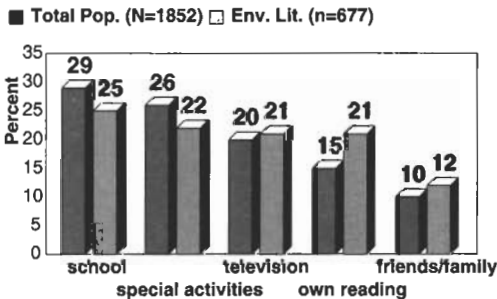
**Figure S.3: Degree of Interest in Studying Environmental Topics Relative to Other Subjects (#2)**



*Where do students feel they are learning the most about the environment?*

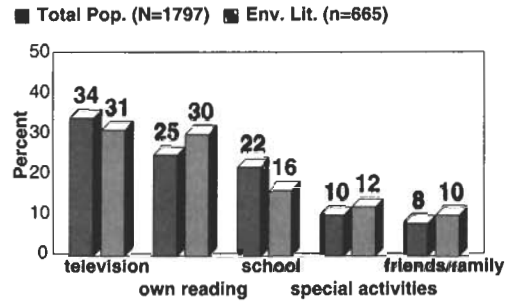
The majority of fifth graders felt school field trips (29%) and special programs or activities (26%) contributed the most to their understanding of environmental problems followed by television (20%) (Figure S.4).

**Figure S.4: Fifth Grade Students' Primary Source of Environmental Understanding (#4)**



Television was the most frequently chosen source of information identified by high school students as contributing most to their understanding of environmental problems (34%), followed by books, newspapers, and magazines (25%). Only 22% of the high school students felt school contributed most to their understanding of the environment (Figure S.5).

**Figure S.5: High School Students' Primary Source of Environmental Understanding (#4)**



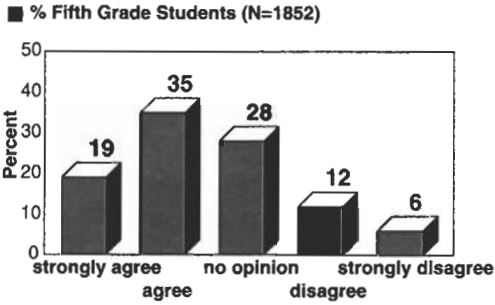
## Part Two: Attitudes and Perspectives on Environmentally Responsible Behaviors

This part of the assessment contained statements relating to students' attitudes towards the environment and environmental problems as well as statements related to their beliefs about their own ability and responsibility to make change relative to the environment. The students responded to each statement using a five-point Likert-type scale (strongly agree to strongly disagree). Questions 5-26 of the fifth grade and 6-35 of the secondary assessment comprise this part (Appendices A and B).

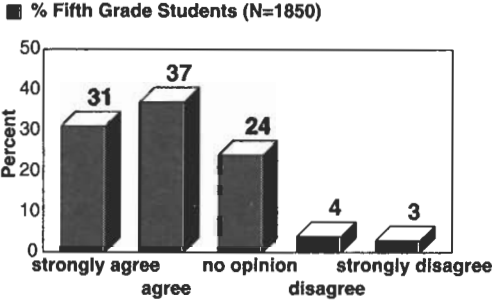
*Are students concerned about maintaining environmental quality and solving environmental problems?*

Yes, responses would suggest that students are concerned. The fifth grade students related their concern about the environment and environmental issues by suggesting that their schools should have more lessons about the environment (Figure S.6). They also felt more money should be spent to solve environmental problems (Figure S.7) and to teach people about environmental problems (Figure S.8).

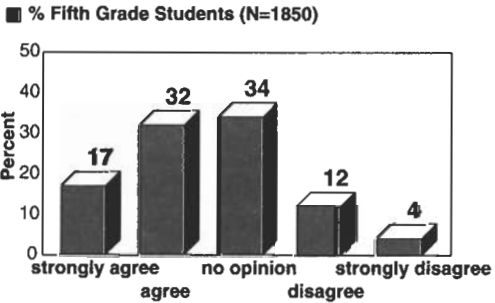
**Figure S.6: My school should have more lessons about the environment. (#8)**



**Figure S.7: More money should be spent to solve environmental problems. (#5)**

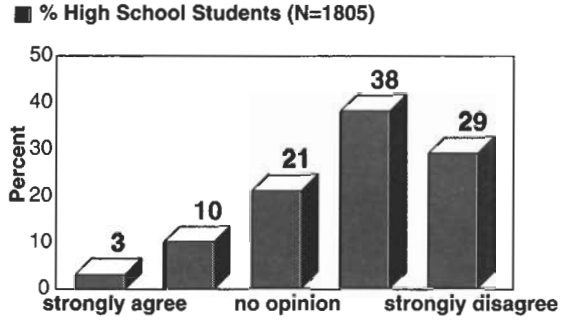


**Figure S.8: More money should be spent teaching people about the environment and its problems. (#7)**

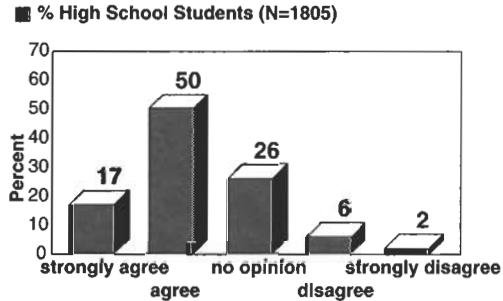


The majority (67%) of high school students disagreed with the statement that environmental concerns or problems have been exaggerated (Figure S.9). Similarly, 67% stated that knowing about environmental issues is important to them (Figure S.10).

**Figure S.9: I think most of the concern about environmental problems has been exaggerated. (#10)**

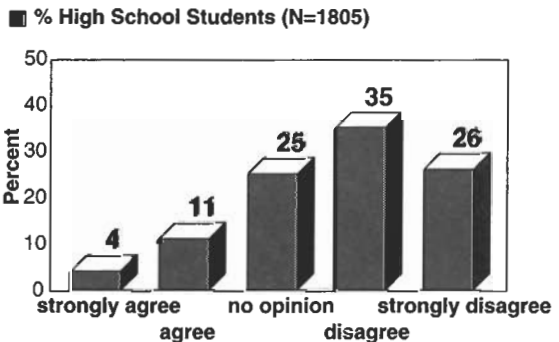


**Figure S.10: Knowing about environmental problems and issues is important to me. (#11)**

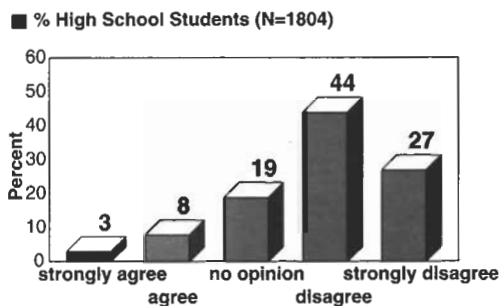


High school students also felt that industrial growth and development should be pursued within the context of appropriate pollution control (Figure S.11). In fact, the majority (71%) felt that there were not enough laws available to protect the environment (Figure S.12). High school students also reported being concerned about a variety of environmental problems including waste, energy, species extinction, environmental health hazards, air quality, and deforestation (Appendix B, items 13, 22, 23, 24, 25, 27, 28).

**Figure S.11: A community's pollution regulations should not interfere with industrial growth and development. (#12)**



**Figure S.12: There are already enough laws to protect the environment. (#17)**

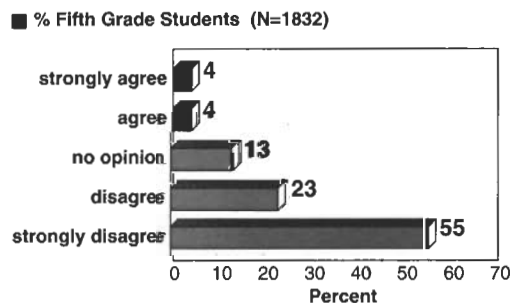


*Do students believe environmental problems can be solved?*

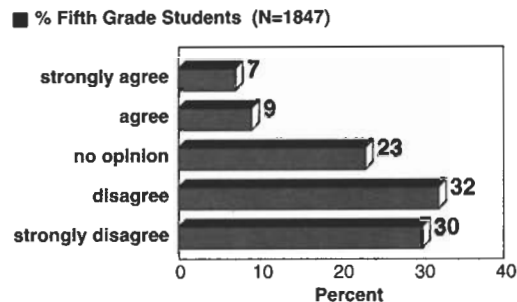
Yes, both groups of students (fifth grade and high school) believed environmental problems can be solved and that they have a personal responsibility to help solve the problems.

Fifth graders did not feel it was a waste of time to work on environmental problems (Figure S.13) and they disagreed with the statement that it is too hard to solve environmental problems (Figure S.14). These students also indicated that they were willing to change their own behaviors in order to solve environmental problems. Figure S.15 shows that almost half of the fifth grade students surveyed said that they would be willing to watch less television to save energy. The majority of these students also disagreed with the statement that the things they do have no effect on the environment (Figure S.16).

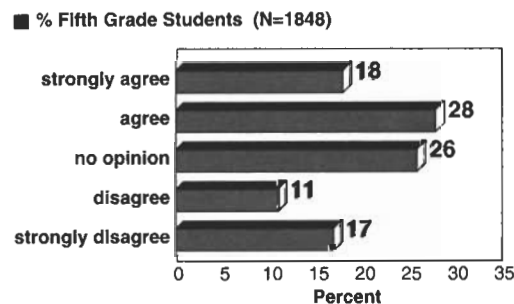
**Figure S.13: It is a waste of time to work to solve environmental problems. (#19)**



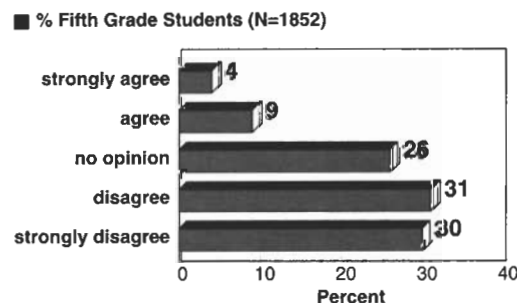
**Figure S.14: It is too hard to solve environmental problems. (#24)**



**Figure S.15: To save energy, I am willing to watch one hour less of television per day. (#16)**



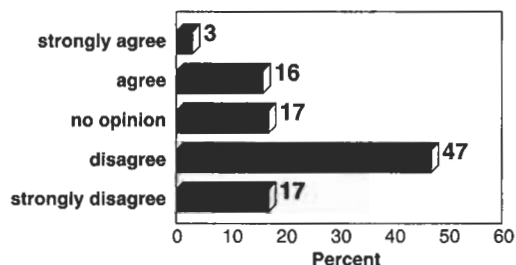
**Figure S.16: Things I do have no effect on the quality of the environment. (#21)**



High school students disagreed with the statement that there is not much they can do to help solve environmental problems (Figure S.17). They believe they can personally contribute to the solution of environmental issues (Figure S.18).

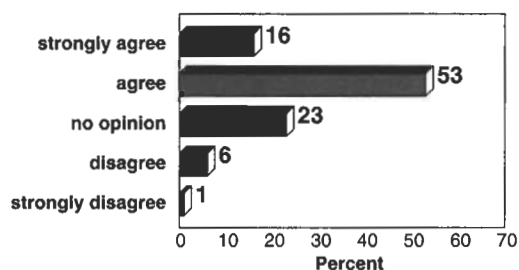
**Figure S.17: There is not much I can do that will help solve environmental problems. (#30)**

■ % High School Students (N=1804)



**Figure S.18: I believe that I can contribute to the solution of environmental problems by my actions. (#31)**

■ % High School Students (N=1804)



### Part Three: Environmentally Responsible Behaviors/Actions

In this part, students were asked to respond to statements about their personal environmental actions or behavior. The students responded to each statement using a five-point Likert-type scale ranging from “never” to “almost always.” Questions 27-40 of the fifth grade and 36-51 of the secondary assessment comprised this part (Appendices A and B).

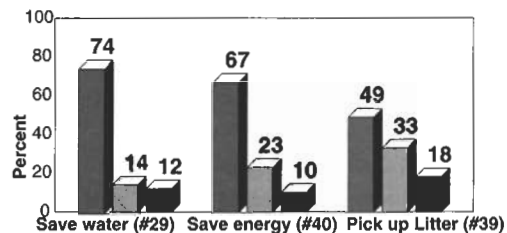
*Do students perceive themselves as being involved in environmental action taking?*

“To a moderate extent” would seem to be the best description of the perceived action taken by students. Fifth grade and high school students reported that they almost always or often take direct action like saving energy, waste reduction/recycling, and conserving water (Figures S.19, S.20). However, when it comes to influencing others such as family and friends, most students tend to show less commitment (Figures S.21, S.22). For example, high school students felt they very seldom

encouraged others to recycle or to stop activities that might negatively impact the environment.

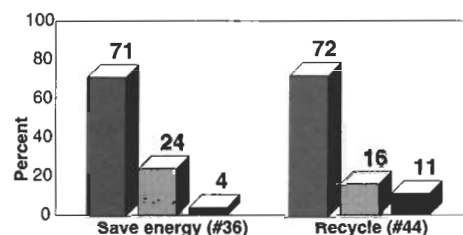
**Figure S.19: Reported Frequencies of Selected Environmental Actions Taken by Fifth Grade Students (N = approximately 1,800)**

■ Almost Always/Often □ Sometimes ■ Almost Never/Never



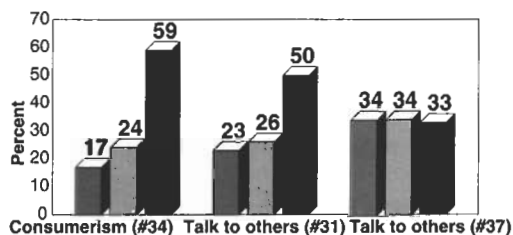
**Figure S.20: Reported Frequencies of Selected Environmental Actions Taken by High School Students (N = approximately 1,800)**

■ Almost Always/Often □ Sometimes ■ Almost Never/Never



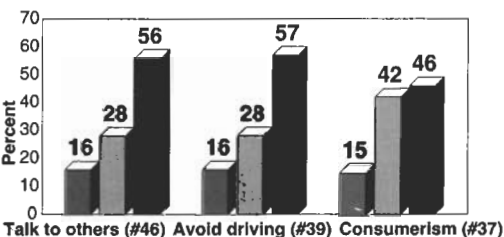
**Figure S.21: Reported Frequencies of Selected Environmental Actions Taken by Fifth Grade Students (N = approximately 1,800)**

■ Almost Always/Often □ Sometimes ■ Almost Never/Never



**Figure S.22: Reported Frequencies of Selected Environmental Actions Taken by High School Students (N = approximately 1,800)**

■ Almost Always/Often □ Sometimes ■ Almost Never/Never



Similarly, purchasing power was not pursued as an option for environmental action by students. They did not to any great extent see themselves as purchasing or avoiding the purchase of products because of environmental concerns.

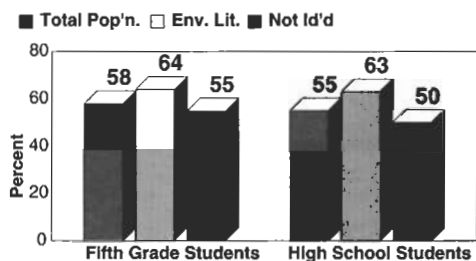
#### Part Four: Knowledge of Ecological Foundations and Environmental Issues

This part contained objective multiple choice questions that were intended to test student knowledge and awareness about ecology and environmental problems. Questions 41-79 of the fifth grade and questions 52-90 of the high school assessments comprised this part.

##### *Do students have adequate knowledge and awareness of ecology and contemporary environmental issues?*

The best answer to this question seems to be “Not quite passing.” Figure S.23 shows that the total population (TP) of fifth grade students scored an average mean of 58%. That is, on the average they answered 58% of the questions correctly. Similarly, the total population of high school students, on the average, answered 55% of the cognitive questions correctly. In both cases (i.e., 58% or 55%), these scores would fall short of the traditional benchmark of 70% as passing. It is important to remember that the questions in this test were developed, reviewed, and selected by relevant teachers with the assumption that students at the given level should be able to answer the questions correctly.

**Figure S.23: Cognitive Subscale Percent Correct by Group**



Those students who were identified as more prone towards environmental literacy (EL) scored

significantly higher than those who were not identified (NI). Figure S.23 shows that EL fifth grade students scored 64% and EL high school students scored 63% compared to 55% and 50% respectively for the not identified students. This would indicate that the test is sensitive enough to discriminate between levels of achievement. However, the EL scores are still lower than the traditional passing mark of 70%.

A more positive interpretation of the results for both the high school and fifth grade is that a majority of students (>50%) selected the preferred answer for most of the questions. This might indicate a majority of students are at least beginning to develop a basic awareness of ecological concepts. Similarly, the majority of students seem to be developing basic awareness of the existence and types of environmental issues that are facing society.

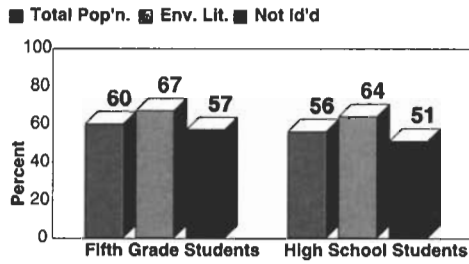
The overall cognitive section can also be further broken down into two separate areas of concentration or subscales. Questions 41-56 in the fifth grade and questions 52-69 in the high school instrument dealt with the understanding of ecological concepts and processes. The second area, knowledge of contemporary environmental issues, was assessed with questions 57-79 in the fifth grade test and questions 70-90 in the high school test.

#### Knowledge of Ecological Foundations

The total population of fifth grade students scored an average mean of 60% on the ecological knowledge questions (Figure S.24). There seems to be an inconsistency or lack of an obvious pattern to these responses. They did well with some basic ecological terms (e.g., Appendix A #42, #43), however, they were limited in their understanding of how energy flows through a system (Appendix A #50, #51, #53). It was particularly disheartening that so many students were unable to identify the sun as the original source of energy for living things.



**Figure S.24: Ecological Knowledge  
Percent Correct by Group**



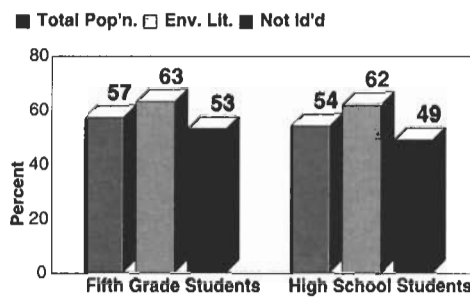
The secondary students had a similar response pattern to that of the fifth grade students (Figure S.24). However, their average mean score was lower at 56%. They, too, seemed to be inconsistent or limited in their understanding of ecological concepts. They did fairly well on common terms like adaptation, habitat, and decomposers (Appendix B #53-55). However, they had obvious problems with more broad based concepts such as carrying capacity and chemical build-up (Appendix B #63 and #64).

In general, both the fifth grade and the high school scores on the ecology questions were lower than expected by the educators developing the test questions. Additionally, it is difficult to understand why the high school students scored even lower on the average than did the fifth grade students given the tests for each population were developed from the same framework.

### Knowledge of Environmental Issues

The second subscale of the cognitive portion of the test consisted of questions about awareness and knowledge of contemporary environmental issues. Again, average mean scores of the total population were not overly impressive (Figure S.25). Fifth grade students scored an average mean of 57%. The high school students scored an average mean of 54%. The environmentally literate group scored significantly higher with average mean scores of 63% and 62% respectively.

**Figure S.25: Knowledge of Environmental Issues  
Percent Correct by Group**



Each test included questions on issues related to energy, population, waste, water, air, soil and biodiversity. Given that an understanding of environmental issues requires a higher cognitive level of operation, it was hoped that more high school students would consistently show greater knowledge of issues than fifth graders. However, as Figure S.25 shows, this was not the case.

## Summary

The Wisconsin Student Environmental Literacy Assessment was administered to determine the status of the state's K-12 student population relative to environmental attitudes, knowledge, and behaviors. Results indicate that students feel education about the environment is important. They believe environmental issues can be prevented and remediated. They hold themselves and society responsible for proactively dealing with environmental issues. The students' ecological knowledge base was lower than the standards established by relevant educators. Students' personal behaviors or actions related to environmental concerns were inconsistent and seemingly without strong commitment. Implications and strategies related to these findings are presented in Section IV of this document.