



## Pacific Environmental Institute Assessment Project (1998 – 2008)

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An Environmental Education Assessment Project now\* managed by the Pacific Education Institute (PEI) was created in 1998 to study and report on the assumption that using the environment to integrate subject areas results in measurable improvements in student learning. Through research and development of standards, PEI's goal is to deliver statistically sound evidence of improved student learning in classrooms using the integration of natural and social environments as a context for learning.

Under the direction of Dr. Catherine Taylor, Professor of Educational Psychology, University of Washington and assessment consultant to OSPI, the PEI partners undertook systematic research to determine answers to the following research questions.

### Research Question 1. How extensively is environmental education practiced in schools in Washington State?

In 2002, the PEI partners conducted a survey of 14 regional and statewide environmental education providers and determined that out of 2,116 Washington State public and private schools, more than half (1,140 or 53.3 percent) have at least one classroom involved in environmental education programs. With this critical mass being achieved without a concerted and coordinated effort at the state level, these survey results indicate there may be an opportunity for setting standards for environmental education providers. (PEI Technical Report 17)

### Research Question 2. What should students know and be able to do in environmental education in the context of Washington State's Essential Academic Learning Requirements (EALRs)?

To meet this need, the PEI partners, guided by the Office of the Superintendent of Public Instruction, developed integrated environmental education benchmarks to measure student performance (5th, 8th and 12th grades) on

- Understanding natural and social systems
- Undertaking research-based science and social science inquiry
- Civic Participation and Policy Analysis
- Communication through the Language, Visual and Performing Arts

Future work will focus on classroom-based performance assessments, such as research projects, anchored by PEI's environmental education benchmarks. (PEI Technical Reports 1 and 2)

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\* The PEI Assessment Project began as a consortium of environmental educators co-sponsored by Project Learning Tree and the Washington Forest Protection Association (WFPA), Project WILD and the Washington Department of Fish and Wildlife (WDFW), Project WET of the Department of Ecology (DOE) and the Washington State Office of the Superintendent of Public Instruction (OSPI). Participants now also include classroom teachers and administrators from twelve school districts, two field study institutes, residential environmental education learning centers, educational service districts, several state agencies, national environmental education programs, non-profit organizations, and the business community.

### **Research Question 3. How will we know whether students are meeting the integrated environmental education benchmarks?**

To determine student achievement in environmental education, the PEI Assessment Project created

- A package of model performance tasks and WASL-like test items (modeled after the Washington Assessment of Student Learning (WASL), the state's student achievement tests) based on integration of core knowledge, skills and understandings in language arts, reading, writing, geography, civics, math, natural and social sciences, plus language and fine arts; and
- Scoring criteria for evaluating quality of student work. (PEI Technical Reports 4 & 5)

### **Research Question 4. How do we ensure the quality of the integrated WASL-like environmental education tests used to measure student achievement on the integrated benchmarks?**

In fall 2001, the PEI Assessment Project conducted a formal research project to test validity and reliability of the WASL-like EE tests through student responses. The K-12 field study involved 67 teachers and 140 classrooms; environmental education tests were administered to over 3,000 students and the participants provided constructive critiques. To ensure the validity and reliability of the assessment tools, adjustments were made to the tests and scoring criteria for student responses were fine tuned in preparation for the formal research project reported in Research Question 8. (PEI Technical Report 7)

### **Research Question 5: What are the criteria for best practices for EE in schools?**

The PEI Assessment Project needed criteria for best practices in order to define what a school or classroom practicing high quality environmental education looked like, and to be able to make comparisons between schools and classrooms. To assess how the EE best practices are being implemented by a school building an EE Rubric was created by the PEI. In this rubric, the best practices were defined for school building involvement in the outdoors, including natural areas, and for classroom teachers' commitment to integrated curriculum plans, instruction, assessment and community involvement. The ranking criteria ranged from 0-4, with each level of involvement specifically described. Sources for these criteria were drawn from nationally recognized best practices research. The implementation of each of the practices described above is scored based on longevity and extent within each school of each practice. The rubric can be used as a tool to evaluate the existing level of environmental education best practices within a school. The rubric may also be used to make program adjustments toward meeting the goal of using best practices in environmental education.

Research by Oksana Bartosh has established the reliability and validity of this EE program evaluation tool. To test the EE Rubric, a survey was developed and distributed among WA public schools in 2002-2003. One hundred and thirteen responses were received, out of which 71 respondents were from EE schools and 42 respondents from schools with traditional curriculum. For each school two to three people completed the survey. One rater was an external expert, and two others were staff (a teacher or a principal). All the survey data was analyzed using several statistical procedures (e.g. descriptive statistics, t-tests, factorial analysis, etc.). To ensure the validity and reliability of the EE Rubric scoring procedure and scoring rubrics, inter-judge agreement data was analyzed. To evaluate the quality of items inter-items correlations, item-final score correlations and descriptive statistics were used. The results indicate a high correlation between external raters and school based raters. Overall, the EE Rubric provides a reliable measure of a school building's EE programming. (PEI Technical Report 3)

### **Research Question 6: How do schools that systematically use environmental education compare on WASL scores to schools who do not?**

In 2002, the PEI Assessment Project conducted a study to compare WASL performance between demographically matched environmental education and non-environmental education schools. Schools were classified based on their rank on the best practices criteria (Research Question 5). The research project identified 77 pairs of schools, comparing a school that integrated environmental education with a demographically equivalent school with traditional curricula. Schools were rated on the best practices

criteria by at least two of the following raters: teacher, administrator and community EE provider. Raters responded to surveys, phone interviews or completed computer administered surveys.

The research demonstrated consistently higher test scores on state standardized tests (math, reading and writing) for environmental education schools versus demographically comparable non-environmental education schools. The study of the 77 school pairs provided a clear trend or pattern indicating that environmental education is one factor that improves student learning at the school building level. This research provides sufficient evidence to justify exploring the relationship between student learning in the context of the environment and integrating subject areas (PEI Technical Report 6)

**Research Question 7. How do individual students' scores compare on WASL and WASL-like tests between EE schools and non EE schools? A study of middle and elementary schools.**

In 2003-2003, PEI conducted a study to explore the difference in individual students' performance on the WASL and WASL-like tests in EE schools and schools with traditional curriculum. Integrated EE-based WASL-like tests were administered to grades 5 and 8 students in 13 public schools in WA, and the results were compared to students' scores on standardized tests in math, reading, writing and listening. Quantitative analysis (descriptive statistics, t-tests, etc.) shows a strong correlation between EE scores and standardized scores in math, reading and writing, with students from EE schools performing higher on EE and state tests than students from schools with traditional curriculum.

*Middle Schools Study:* At the middle school level, students in EE schools tend to have higher scores on the Inquiry, Systems, and Civics WASL-like tests, and this difference was statistically significant ( $p(\text{inquiry})=0.036$ ;  $p(\text{systems})=0.001$ ; and  $p(\text{civics})=0.000$ ). Similarly, analysis of the individual students' WASL test scores in math, reading, writing, and listening indicated that on average students from EE schools have higher scores on these tests (strong statistical significance for math and writing).

*Elementary Schools Study:* Analysis of the individual students' scores from EE and non-EE elementary schools indicates that students from EE schools performed better on the Inquiry WASL-like test with average scores of 50.8 for EE schools compared to 46.6 for students from non-EE schools, and this difference was statistically significant. However, there was no statistical difference between students' scores on the Systems WASL-like tests. Similarly, analysis of the state's WASL test scores for individual students shows that although students from EE schools tend to receive higher scores on all four tests (math, writing, reading and listening), the difference between students from EE and non-EE schools is not statistically significant.

Our results support the anecdotal evidence of the beneficial impact of EE on students. This study illustrates that students learning through academic EE programs perform at the same level or higher than students in traditional classrooms. These findings suggest that by providing a real world (environment based) context for learning, rigorous environmental education could support schools' accountability efforts to integrate discipline standards and improve student performance. (PEI Technical Report 15)

**Research Question 8: Do the WASL-like EE tests predict student performance on state WASL tests for reading, writing and math?**

To address the value of environmental education to student learning, the PEI Assessment Project conducted research to look at the relationship between student performance on environmental education WASL-like tests and student WASL (state standard) scores on math, reading and writing. During Spring 2003, 697 students from fifth and eighth grades completed 1,864 WASL-like environmental education tests for Systems Understanding, Inquiry and Civic Participation. The results provided statistical evidence for the validity of the WASL-like tests as a measure of Washington State EALRs for math, reading and writing. (PEI Technical Report 7)

The findings validate the use of the Integrated Benchmarks and associated WASL-like tests as tools that fit with academic environmental education programs and effectively measure improvement in Washington State Essential Academic Learning Requirements (EALRs) for math, reading and writing. Results from this

on-going research provide teachers and school districts confirmation that quality environmental education makes a positive difference in student learning.

**Research Question 9. Is there a correlation between WASL Science scores and WASL-like EE-based assessment scores? (In progress)**

During 2004-2005, PEI conducted a study of student performance on the science WASL in relation to the WASL-like assessments. Inquiry WASL-like tests were administered to approximately 700 Grade 7-12 students from two schools in the Tahoma School District. Currently the data is being analyzed using statistical procedures, to analyze for any correlations between students' WASL scores and their scores on the Science WASL test. PEI predicts a strong relationship because of the environmental education benchmark focus on natural science systems and inquiry.

**Research Question 10. Is the new scoring rubric for WASL-like Science Inquiry reliable and valid? (In progress)**

The goal of this project is to establish the reliability and validity on a new scoring rubric developed by PEI for Inquiry tests which focus on experimental design. This new rubric was developed to assess students' skills in designing experiments and will allow teachers to gain more detailed information about students' inquiry skills. Responses of 700 middle and high school students on a WASL-like Inquiry test are being analyzed to establish the reliability and validity of the rubric.

**Research Question 11. What inquiry and experimental design skills are demonstrated by middle and high school students? (In progress)**

This project analyzes the responses of 700 middle and high school students on an Inquiry WASL-like test to gain more detailed information about students' ability to design science experiments, and their understanding of different steps of the inquiry process.

**Research Question 12. Evaluating teacher confidence to conduct inquiry in the outdoors.**

The 2005 Science Institute: Focus on the Physical Properties of Earth Materials, was a two day Institute designed for third and fourth grade classroom teachers held at The Tacoma Nature Center. Nineteen educators attended the Institute. Teacher confidence was measured by a pre and post self assessment survey of scientific inquiry instruction and field investigation skills. Participants on average reported improvement in their 'confidence' level.

The evaluation also provides data on teacher confidence in the use of the following: EE and scientific inquiry; teacher needs and barriers to using EE programming in their classroom; teacher feedback on what is and is not useful regarding the specific professional development experiences. It is notable that the Institute participants had on average a Masters Degree. Teachers reported integrating EE into 40% to 50% of their instructional time. Fewer than 30% of the teachers included the use of the outdoors or natural areas in their science inquiry related Environmental Education activities. (PEI Technical Report 18)

**Research Question 13. What kind of learning happens in rigorous high school environmental education programs? (Ph.D. Research in progress)**

Conducted by Oksana Bartosh, this study investigates the influence environmental education programs have on student learning of high school students. Specifically, the project explores ways in which rigorous environmental education influences high school students' regarding; environmental literacy, environmental ethics; social competency (such as cooperation, sense of responsibility, peer interactions); attitude toward school and learning; and academic achievement in math, writing and science. The study, designed as a comparative study of two high school programs, uses mixed method research methodology and analyzes possible differences in learning experiences and achievement for students participating in EE and in traditional programs.

## **Conclusion**

By empowering educators to provide challenging, 'learning-by-doing' experiences they can improve student academic performance in Washington State. When learning is active and collaborative students learn from one another. They learn by participating in activities and by applying their learning in new contexts. Building on prior knowledge and experience is critical to understanding ideas and principles. Practice and application to real world situations are essential to improving student achievement.

The Pacific Education Institute is preparing to conduct the following research:

1. **Field Science Inquiry Instructional Model:** Study of student learning in science inquiry comparing field investigation with experimental design.
2. **Student Retention:** Qualitative research to determine if students involved in rigorous environmental education programs stay in school at a higher rate.

## **Environmental Education Assessment Project Funding Partners Include:**

American Forest Foundation  
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National Environmental Education Training Foundation (NEETF)  
EPA Environmental Education Training and Partnerships (EETAP)  
National Project Learning Tree Program  
Washington Forest Protection Association (WFPA)  
Washington Department of Fish and Wildlife (WDFW)