



Environmental Literacy and Education Outcomes



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Although environmental literacy is often the primary goal of programs that connect young people to their natural surroundings, student learning and academic success can be complementary outcomes.

Academic Achievement/Standardized Test Scores

By comparing standardized test results from 114 schools in Washington state, researchers demonstrated that scores were often significantly higher for those students who attended schools with well-developed programs that boosted environmental literacy than schools without those programs. For example, researchers found that 8th graders at 20 schools with programs that connected students to nature scored significantly higher in math and writing and somewhat higher in reading and listening than schools that did not offer those programs. By administering their own tests, researchers also found **higher proficiency in inquiry skills, understanding of systems and civics.** (Bartosh, Tudor, Ferguson, & Taylor, 2006)

programs that connected students to nature scored significantly higher in math and writing

Fourth graders in Houston, Texas participated in a **Schoolyard Habitat** program offered by the **National Wildlife Federation**. The program combines a certification process for designated wildlife habitat on school grounds, use of the site as an outdoor classroom, and implementation of hands-on science and stewardship activities. Data collected from standardized test scores and science grades revealed that the Schoolyard Habitat Program was equally effective as traditional science curriculum in terms of science instruction. Qualitative data suggests that students who participated in the **program showed increased interest in and understanding of science** when compared to students exposed to traditional science curriculum. (McFarland, Glover, Waliczek, & Zajicek, 2013)



Another evaluation of the National Wildlife Federation's Schoolyard Habitat Program in three Houston elementary schools found significant improvements in the standardized mathematics test scores of the 306 students who participated in the program, compared with the 108 students who did not participate in the program. These changes were measured over a two-year period from the time students started third grade to the time they finished fourth grade. (Danforth, 2005)

42%
of participating
students scored
higher in tests

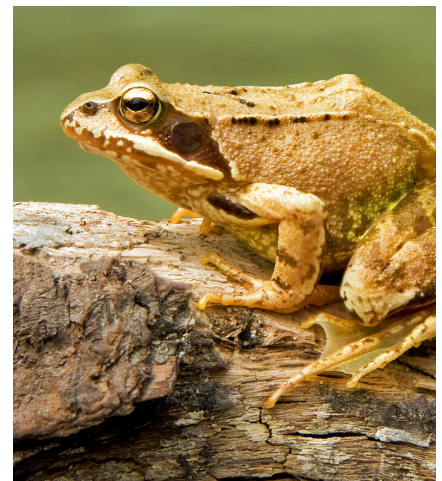
Researchers examined standardized test scores for second to fifth graders in eight California elementary schools. In 42% of the cases, students from the schools that implemented programs aimed at improving environmental literacy scored significantly higher in reading, mathematics, language arts, and spelling than students from the schools that did not implement these programs. (State Education and Environment Roundtable, 2005)

Content Knowledge and Understanding

As part of a field trip to a botanical garden, tenth graders in Germany participated in a one-day learning program about climate change. Topics covered included science concepts such as the greenhouse effect, climate, plant adaptations, ecosystem types, historical climate change, and impacts of climate change. Before, immediately after, and four to six weeks after the field trip, students completed a 30-item multiple-choice test to measure cognitive achievement. Researchers also administered the test at the same time intervals to a group of students who did not go on the field trip. Results indicated significant **short-term and long-term gains in knowledge** for the students who participated in the learning program at the botanical garden; similar gains were not seen for students who did not participate in the program or field trip. (Sellmann & Bogner, 2013)



Third and fourth graders in Germany learned about amphibian biology and conservation as part of their normal classroom instruction. A subset of this group also participated in an outdoor education program where they worked with university students to identify and count amphibians in their town during a two-week time period. All students completed a test before the lesson, one week after completion of the lesson, and four to six weeks after the lesson was completed. While test results showed that both groups significantly increased their knowledge of amphibians (both in the short and long term), the **students who participated in the additional outdoor program received significantly higher scores** on all post-experience tests when compared to the student who did not take part in the outdoor program.



(Randler, Ilg, & Kern, 2005)

Middle school students from six states took part in the Student-Teacher-Scientist Partnerships program (STSPs), a program that provides learning experiences led by park rangers, scientists, and teachers and involved experiences both in Yellowstone National Park and in students' home classrooms. Researchers used pre- and post-experience tests to assess student content knowledge concerning the geosphere, hydrosphere, atmosphere, biosphere, and local Yellowstone National Park concepts. Statistically significant gains were found across all content areas for the students. (Houseal, Abd-El-Khalick, & Destefano, 2014)

Competencies (Skills)

Ninth and twelfth graders in Florida participated in a school program that used the local environment as the main context for learning throughout the year. Students completed a test of **critical thinking skills** at the beginning and end of the academic year. When compared to a control group of students who did not participate in the program, both 9th and 12th graders showed significant increases in their critical thinking skills. The 12th graders also demonstrated significant increases in disposition toward critical thinking, a measure that examines a student's willingness and likelihood to use critical thinking. (Ernst & Monroe, 2004)

Seventh and eighth graders in four urban schools in Israel participated in a 30-hour long program to boost environmental literacy as part of their science curriculum. The unit focused on water and incorporated inquiry-based knowledge integration activities and an outdoor learning component. Pre- and post-test results indicated significant increases in students' **cyclic thinking and systems thinking**, skills identified as important in contemporary science education. (Assaraf & Orion, 2009)



increases in students' willingness and likelihood to use critical thinking

Dispositions

Ninth and twelfth graders from eleven Florida high schools participated in a year-long program that used the local environment as a context for learning. Students were also assessed on a 20-item Achievement Motivation Inventory that measured students' excitement about learning, feelings of success and failure, personal motivation to learn, and interest level in subject material. Assessment results demonstrated significant increases in **academic achievement motivation** for both age groups. Qualitative data revealed that both students and teachers credited this increase in academic motivation to the flexibility in this nature-based curriculum; they describe it as being both applicable to real-life issues and easily adaptable to students' interests and strengths. (Athman & Monroe, 2004)

In three elementary schools and two middle schools in Maryland, teachers used a program that used the Chesapeake Bay watershed as an integrating context for learning. Evaluation data indicated that **student engagement in learning** was significantly more positive for students who were described as being in classrooms where the program was greatly emphasized when compared to students in classrooms where the program did not receive an emphasis. (Secker, 2004)

Multiple Outcomes

Researchers conducted a literature review of 48 studies that examined the academic outcomes of garden-based learning in schools. Overall, the studies reported success in increasing academic outcomes for students – over 90% of the studies reported significant positive outcomes. Studies examined both direct (e.g., science, math, language arts, and social studies achievement) and indirect academic outcomes (e.g., attitudes towards academics, motivation, problem solving, and study habits). *(Williams & Dixon, 2013)*



positive academic outcomes in schools with garden-based learning



Researchers conducted a survey with 338 educators across 55 schools that had participated with their students in four place-based education programs that included a focus on nature. Survey results indicated that the place-based education programs were associated with **increased ability of educators to meet curricular goals**, increased student academic motivation and achievement, and increased student engagement in learning. The study also documented positive changes in school culture. *(Duffin, Powers, Tremblay, & PEER Associates, 2004)*

In partnership with 12 State Departments of Education, researchers conducted a study of 40 schools that examined the effects of using Environment as an Integrating Concept (EIC) framework. Results indicated that students in EIC schools had higher scores on standardized measures of **achievement in mathematics, science, reading, writing, and social studies**. The students also showed increased engagement and enthusiasm for learning, and a greater **pride and ownership in their own learning**. *(Lieberman & Hoody, 1998)*