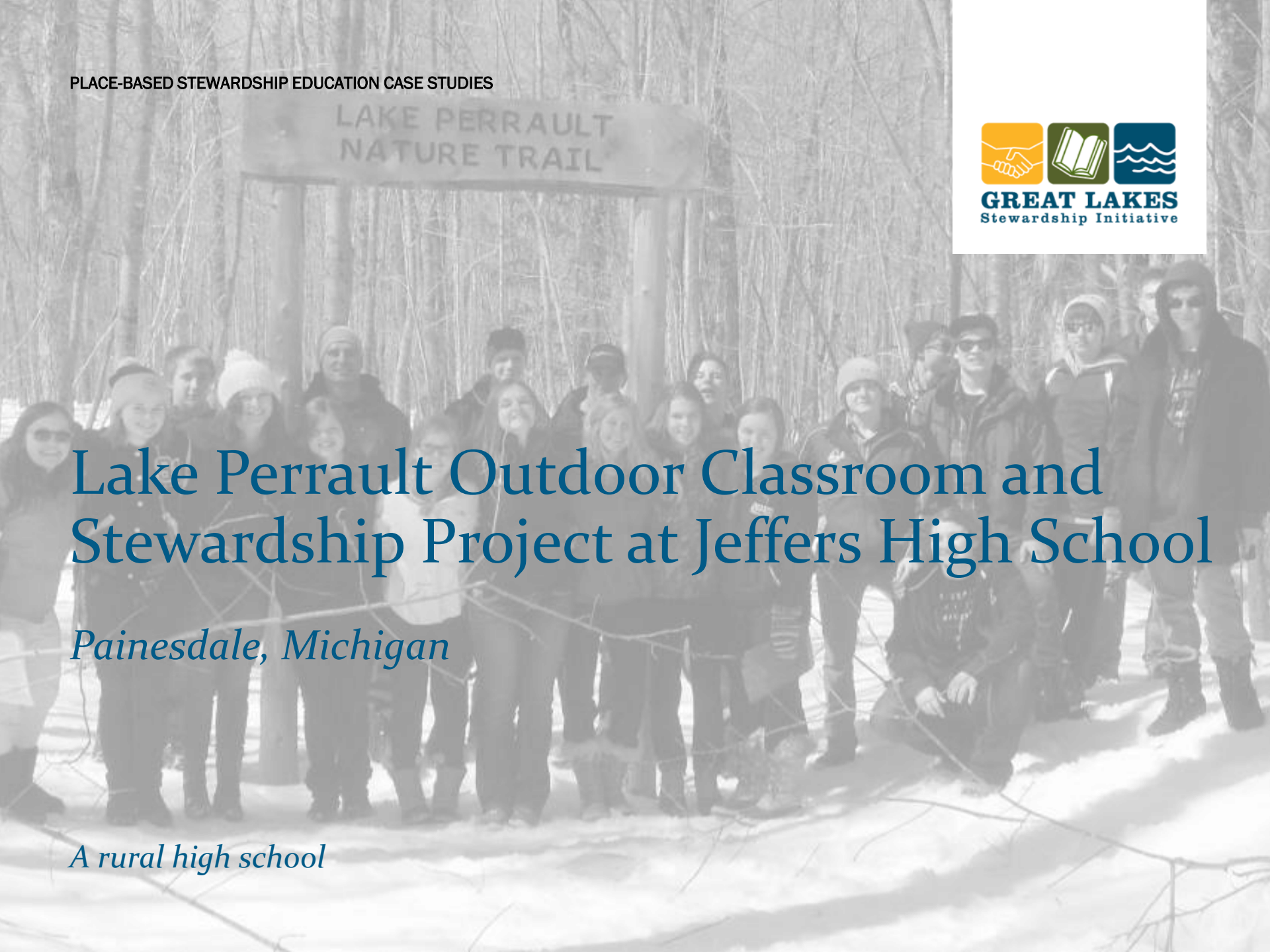

GREAT LAKES
Stewardship Initiative

Lake Perrault Outdoor Classroom and Stewardship Project at Jeffers High School

Painesdale, Michigan

A rural high school

About the case study

This case study of place-based stewardship education (PBSE) at Jeffers High School is one of 11 case studies developed by staff of the Great Lakes Stewardship Initiative (GLSI), staff of the GLSI's nine regional hubs, and the educators whose work is featured in the study.

The case studies focus on PBSE efforts during the 2014–15 school year. At most of the sites featured in these studies, the PBSE approach has been developed over the course of several years.

Each school featured in a case study works with the GLSI through a regional hub. Hubs provide professional development for educators, help schools connect and partner with community-based organizations, and provide funding and other PBSE supports with an environmental stewardship emphasis. Jeffers High School has a longstanding relationship with its hub, the Lake Superior Stewardship Initiative, or LSSI.

Cover: Students in Jeffers' environmental literacy class visit Lake Perrault in winter.

Lake Perrault Outdoor Classroom and Stewardship Project at Jeffers High School

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Contents

Conventions in this document

As you read this study, you will see special icons in the text.

This icon marks a teaching tool, resource, or product that you can access and download from the case study.

This icon marks a connection between the work being described and the GLSI's Guiding Principles for Place-based Stewardship Education, developed by GLSI central and hub staff to describe the GLSI's vision for exemplary place-based stewardship education. Certain aspects of each case study illustrate how one or more of the principles can be enacted in classrooms and communities.

Quick Summary

Studying and stewarding Lake Perrault and the Robert T. Brown Nature Sanctuary

In 2014–15, Jeffers High School students continued their long-term work at these sites and added a weather station and new activities.

For several years, Jeffers High School students have spent significant time each year at Lake Perrault and the adjacent Robert T. Brown Sanctuary, exploring, doing scientific research, adding improvements, and enjoying the outdoors in all seasons.

This site, just three miles from the school, includes properties owned by the State of Michigan and by the Michigan Nature Association. Lake Perrault has been a popular public recreation site for decades, but had become degraded by careless motor and foot traffic and by litter. Students decided to "adopt" these sites—to learn about them, restore them, and protect them. Their work has been ambitious and wide-ranging, and students have had a voice in organizing and executing it.

Over the years, students have completed biological inventories and investigations at both sites, conducted research on invasive plants and deformities in frogs, built a trail and designed interpretive signs, constructed a viewing platform and bridge, installed a weather station, produced a brochure about the history of Lake Perrault, and shared some of their learning with elementary students.

From top: Students record data about forest composition; measure the dimensions of a vernal pool during a site inventory; and use field guides for species identification.

"Our project aims to restore and enhance Lake Perrault and surrounding area and steward the Brown Nature Sanctuary—using both as an outdoor classroom. By engaging students in stewardship activities, we seek to ensure that the water and land do not become degraded again."

—Chuck Palosaari, Jeffers High School teacher

QUICK SUMMARY

Community Context

Context is essential in place-based stewardship education

There is perhaps no more distinctive characteristic of PBSE than its treatment of place as the context for learning.

Our sense of place does not exist in only one geography, and It changes as we age. When we are very young, we may experience our strongest sense of place in our homes, neighborhoods, and favorite places for play. As we grow, we begin to understand that we are members of other communities, too—a school community, a city or town, a watershed, a state, or a bioregion such as the Great Lakes.

PBSE relies on place—including lands and waters, people and organizations, history, and culture—as a starting point for teaching and learning. Reading about rainforests or deserts may be interesting, but environmental learning grounded in students' home communities builds on a foundation of community attachment and place-based knowledge.

For Painesdale youth, that foundation includes a landscape that is still rich in natural resources, a community that respects its history as a copper mining center, and a strong regional tradition of spending time outdoors in all seasons.

Map of Michigan school districts: Michigan Department of Technology, Management & Budget (2011).

Jeffers High School is located near the tip of Michigan's Upper Peninsula, in the inland, rural community of Painesdale

Michigan's Upper Peninsula contains 29 percent of of the state's land area but only 3 percent of its population. The western Upper Peninsula receives an abundance of lake effect snow and provides a beautiful winter playground. Its shorelines and vast forests attract visitors in spring, summer, and fall. Healthcare and travel and tourism industries provide nearly half of the region's jobs.

Painesdale is an unincorporated small town in Adams Township, in the middle of the Keweenaw Peninsula. As of the 2010 census, nearly half of the township's 2,573 residents were of Finnish descent, reflecting the large-scale migration of Finns to the western Upper Peninsula more than a hundred years ago to work in the copper mines.

Michigan Technological University (MTU), known for its excellent degree programs in engineering and forestry, is located in Houghton, just ten miles northeast of Painesdale.

Painesdale, a copper mining town, was established at the turn of the 20th century

The community is listed on the National Register of Historic Places.

Throughout the 19th century, copper was king in the western Upper Peninsula. "Native copper," an especially pure form, occurred here in relative abundance, and the Keweenaw Peninsula's native copper district alone produced nearly 11 billion pounds of copper. For a portion of the 19th century, copper produced in the western Upper Peninsula accounted for more than 95 percent of total copper production in the entire United States.

Painesdale was built by the Champion Mining Company and the Copper Range Consolidated Company between 1899 and 1917. The town's Champion mine had four shafts and was an important source of copper from 1900 to 1930. For the next several decades, however, its production was sporadic. Today, there are no active mines here.

Rows of saltbox houses originally built for mine workers still line the streets of Painesdale. Photo by Andrew Jameson - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=15801322

The students' stewardship efforts target locally significant recreation and conservation sites

Lake Perrault, owned by the State of Michigan, has been a recreation area for the community of Painesdale for decades. Beginning in the 1990s, the site began to show signs of wear and tear: cars were driven indiscriminately across the property, causing soil compaction and ruts; there was no designated parking area; campfire rings were randomly located along the shoreline; and trash was a constant eyesore.

The Michigan Nature Association owns the neighboring Robert T. Brown Nature Sanctuary, named for a professor and plant ecologist at MTU. The 19-acre property features a northern fen surrounded by a pond and bordered by black spruce, tamarack, and white cedars.

Educators at Jeffers High School decided to use these two sites—Lake Perrault and the Brown Nature Sanctuary—for students' hands-on learning and stewardship projects. Their goal was to encourage and inspire young people to appreciate, improve, and protect these special places in their community.

Lake Perrault is the headwater source for the Salmon Trout River, which flows into Lake Superior.

LINK: *ROBERT T. BROWN NATURE SANCTUARY*

LINK: *A STUDENT TALKS ABOUT THE WORK AT LAKE PERRAULT*

Lessons and Activities

PBSE adapts to fit different students, curricula, and communities

Many factors affect the design of PBSE projects in any given teaching and learning context:

- Students' ages/grades/readiness
- Students' interests and questions
- Community stewardship needs and opportunities
- State and local curricular expectations
- Participating community partners and their interests, needs, and assets
- Access to transportation and funding
- Climate and weather

Jeffers High School students' place-based education experiences reflected their particular setting, the school's curriculum and learning goals, and the unique opportunities presented by community partners.

Jeffers High School has a rich history of PBSE

A portfolio of teaching and learning at Lake Perrault and the Brown Nature Sanctuary has been developed over the years.

At Jeffers High School, teachers have utilized Lake Perrault and the Brown Nature Sanctuary for diverse and changing purposes for more than 15 years.

Back in the early 2000s, students' first activity on the sites was to conduct a frog deformity survey. This effort was followed by other, occasional outdoor lessons, without any formal plan or vision at the school level for how the sites could support ongoing teaching and learning. Gradually, teachers came to realize that the sites could function as a permanent outdoor classroom, and the school formalized the relationship with the property owners by "adopting" the sites in 2006.

Several years later, it is still the case that much of the teaching and learning at Lake Perrault and the Brown Nature Sanctuary varies from class to class and year to year. Teachers work collaboratively to design full-school experiences, and individual teachers or small groups have the option to organize additional science, civics, engineering, English/language arts, service learning, or other studies that involve Lake Perrault and the Brown Nature Sanctuary.

Jeffers students work on the trail system.

This case study presents this portfolio of teaching and learning in four sections:

- *Developing and maintaining the outdoor classroom*: This section reviews past and present student work to build and maintain trails and other site amenities.
- *Learning in the outdoor classroom*: This section reviews past and present teaching and learning that relies on the outdoor classroom.
- *New activities in 2014–15*: This section focuses specifically on activities conducted for the first time in 2014–15, the focal year for GLSI case studies supported by grants from the U.S. EPA.
- *Outreach and extensions*: This section considers additional activities, not connected to the outdoor classroom, in which students share, and expand upon, their learning.

Developing and Maintaining the Outdoor Classroom

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Over the years, Jeffers students have constructed a trail, a bridge, a viewing platform, interpretive signs, and an informational kiosk

Jeffers students have performed a significant amount of work at their two adopted sites. They constructed a 1.5 mile-long nature trail around Lake Perrault. They also built a bridge where the lake flows into the Salmon Trout River, and boardwalks and viewing platforms at the Brown Nature Sanctuary. A student-built, wooden kiosk holds informational brochures for visitors.

Construction efforts present opportunities for learning about tools, technology, effective planning, and management. Before trail construction began, students used GPS to map the area around the lake, then determined a route that would avoid fragile areas. Students also learned how to use a pulaski (a hand tool used in firefighting and clearing vegetation) and other tools to remove roots and small saplings.

"I learned from the services that we've done... Not only have we made it easier for people to hike trails around Lake Perrault but we've cut some dead trees and branches to let sun onto the other plants. We did as little damage to the environment as possible."

—Jeffers High School student

The adopted sites serve the public, and they need annual maintenance and cleanup to keep them welcoming and functional

In the early years of their work at these sites, students cleared and marked existing trails at both sites, picked up trash, and removed campfire rings along the lakeshore. Many years of neglect had left Lake Perrault, in particular, in need of significant attention.

In recent years, including the 2014–15 school year, students have continued to work on enhancements to the trail system at Lake Perrault and the Brown Nature Sanctuary. They have also done trash pickup and other routine maintenance.

Students work on an informational kiosk that will hold brochures for visitors.

A student works to clean up debris.

GREAT LAKES
Stewardship Initiative

Learning in the Outdoor Classroom

Every student at Jeffers visits the outdoor classroom at least twice each school year

Lake Perrault and the Brown Nature Sanctuary are rich environments for many kinds of learning. During each school year since 2006, Jeffers students have attended at least two all-school community-learning days at the sites, and have also gone there on field trips as part of their science, English, math, technology, shop, and physical education classes.

Collectively, these experiences build students' knowledge of local habitats and natural resources. Jeffers educators hope that they also help students recognize that what they learn and do in school has broader relevance to their own lives and their community.

"It makes me more aware of my surroundings and what my actions can do to the environment."

—Jeffers High School student

Middle-school students learn how to identify tree species.

LINK: *TV 6 AND FOX U.P. NEWS REPORT ON SPRING 2015 ALL-SCHOOL FIELD DAY*

Students have conducted a frog deformity survey each year

In 1995, a class of students on a hike at a local nature center in south central Minnesota discovered many frogs with deformed limbs jumping out of a local pond. Frogs absorb what surrounds them through their skin. To a lesser extent, so do humans. So this observation—and the many other alarming observations that followed it—caused great concern among scientists and the public.

Since that time, students and other citizen scientists have collaborated with researchers to learn more about this problem. At schools across the country, including Jeffers High School, students conduct an annual survey to detect deformities in local populations of frogs.

Students at Jeffers found good news in their 2014–15 survey—deformities in local frogs were not widespread.

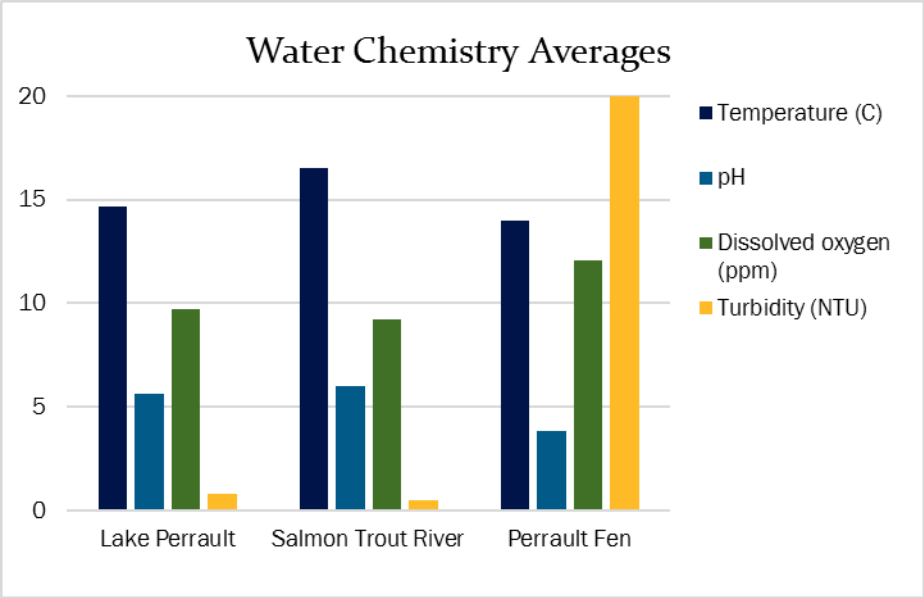
The survey of frog deformities sometimes occurs at night.

Water quality testing has occurred every year

Students test water annually in Lake Perrault, the Salmon Trout River, and the Perrault Fen in the Brown Nature Sanctuary. Using chemical and electronic water quality testing equipment, they record the physical and chemical characteristics of each of these water bodies.

Because the water quality data is collected regularly, Jeffers High School students have access to a time series of data that can be used for learning in science, math, or technology contexts.

A Jeffers student gets supplies from a water quality testing kit.



Students produce charts that compare results from different water bodies.

Students learn about wetlands by collecting data and educating others

Students measure a vernal pool's dimensions.

Students share their knowledge of wetlands with the public during an open house at the outdoor classroom.

Wetlands are interesting, increasingly rare, and often fragile habitats. They help improve water quality and control floods, offer opportunities for recreation, and may harbor highly adapted or rare species. For example, the fen in the Brown Sanctuary is home to carnivorous plants and orchids.

By studying the fen and other wetlands at the Brown Nature Sanctuary during a series of field trips, students have learned about the importance of these areas to the larger environment and the community.

"After taking many field trips to the Brown Sanctuary, students are much more appreciative of the unique characteristics and benefits of wetlands."

—Ashley Coble, GK-12 graduate fellow with Jeffers High School, and PhD student in Biological Sciences at Michigan Technological University

Winter brings new opportunities for recreation and research

Jeffers High School students use Lake Perrault all year long. In winter, students bundle up (and sometimes don snowshoes) to explore the area, study weather-related topics, learn about winter ecology, and practice winter survival skills.

Studying the structure of snowflakes, the timing of snowfall, and the nature of the resulting snowpack allows students to explore topics in math and science, including geometry, physics, and meteorology.

Learning how to not only survive but thrive in the cold, snowy conditions prevalent in Michigan's Upper Peninsula ensures that Jeffers students can maximize their enjoyment and experience of the outdoors.

LINK: *SNOWFALL CHANGE: A CLIMATE CHANGE INDICATOR FROM NOAA*

LINK: *NASA RESOURCE FOR TEACHING WITH A SNOW PIT*

Students measure layers in the snowpack.

Students have studied invasive plants around Lake Perrault

Spotted knapweed is a common and aggressive invader.

The area around Lake Perrault is vulnerable to many invasive species, including spotted knapweed (*Centaurea stoebe*). This plant can reduce the diversity of native plants, and increase runoff and soil erosion, which may reduce water quality.

By conducting periodic surveys, students monitor the spread of these noxious weeds. Their data create a baseline that future students can use to determine the speed and extent of purple loosestrife's invasion.

Photo of knapweed courtesy of Leslie J. Mehrhoff, University of Connecticut, Bugwood.org

High-school biology students use transect sampling to determine the number of spotted knapweed plants at the Lake Perrault picnic and swimming area.

Jeffers High School educators provide time for students to connect with nature

Having students work to improve their environment makes them more likely to take care of a place—this is the long-term goal of Jeffers educators.

Students' work at Lake Perrault and the Brown Nature Sanctuary allows them to learn how fragile their natural environment is, and how they can fulfill their responsibility as community members to take care of their environment.

Through place-based stewardship education--including interactions with community partners and related, environmentally themed classroom activities—Jeffers educators hope to instill a sense of responsibility for the environment in future community members and leaders.

A teacher's passion for fishing can be contagious.

"We want to instill a sense of stewardship in our students, but first they have to have fun and enjoy the outdoors, so we take them fishing at the lake."

—Mike Benda, Jeffers High School Principal

"Our students have benefited, in that we can connect them to the local environment, so what they're learning in the classroom can now become hands-on and they can see these ecological principles in action."

—Chuck Palosaari, Jeffers High School teacher

New Activities in 2014–15

Students, teachers, and partners conducted the region's first BioBlitz

The BioBlitz species inventory built awareness of biodiversity, and is expected to become an annual event.

Senior students conducted a BioBlitz (also known as a biological inventory or census) at the Brown Nature Sanctuary and Lake Perrault. This was an organized effort to get an overall count of the living organisms that occur at the sites. A BioBlitz helps people learn about natural history and the increasingly important topic of biodiversity. Students worked with experts who volunteered their time to help sample, collect, and identify species—including small mammals, frogs, salamanders, insects, aquatic macroinvertebrates, lichens, fungi, flowering plants, and trees.

Students in the computer technology class, who maintain the Jeffers High School page on the LSSI's website, will add each year's BioBlitz information to an online database of species ever found at the site. This will allow students to compare the diversity and abundance of species over time.

Students work in teams to collect and identify aquatic organisms as part of the BioBlitz.

LINK: *NEWS REPORT, TV 6 AND FOX U.P.*

LINK: *DESIGNING A BIOBLITZ FROM NATIONAL GEOGRAPHIC*

A new weather station was installed at Jeffers High School, just a few miles from the outdoor classroom

The Davis Instruments Vantage Pro 2 weather station includes sensors and systems to measure wind speed, wind direction, rainfall, temperature, and humidity. An optional module allows students to download data to a computer for analysis and interpretation.

The weather station allows Jeffers High School students to expand their study of science, technology, engineering, and mathematics (STEM) topics as part of their work at the outdoor classroom. Students can use the weather data they collect to monitor climate change, estimate the beginning and end of the area's growing season, and predict local phenology (cyclic and seasonal natural phenomena that are influenced in part by climate).

Students can also study the water balance—the flow of water in and out—at Lake Perrault, using InsightMaker, a computational modeling software.

A weather station helps students expand their studies of the local environment.

LINK: *STREAM FROM WEATHER STATION*

LINK: *INSIGHTMAKER SOFTWARE*

Students speak with Charles Eshbach, longtime volunteer and staff member of the Michigan Nature Association in the western Upper Peninsula. Mr. Eshbach is also a hiking guide in the Keweenaw Peninsula and an accomplished photographer.

The high school's English class researched the history of Lake Perrault

Jeffers High School students in English/language arts class created a documentary about the history of Lake Perrault and the community's use of this natural feature. For source material, they interviewed a former resident of the area, a fisheries biologist, and a naturalist, all of whom had specific memories and experiences with Lake Perrault.

LINK: *DOCUMENTARY ON YOUTUBE*

“These students have a better sense of their environment … It is less of an abstract idea … and instead something that they touch—and they realize that they’re part of this big ecosystem.”

—Chuck Palosaari, Jeffers High School teacher

Outreach and Extensions

Jeffers students help young students construct papier-mâché globes as part of series of lessons on water resources they led at South Range Elementary School.

High-school students taught elementary students about water resources

South Range Elementary is the only elementary school in the Adams Township School District. Senior high-school students in teacher Cindy McCormick's Environmental Literacy class visited the elementary to teach lessons on water resources to the younger students—many of whom were younger siblings or other family of the visiting high schoolers.

Fiorella and Mayer's (2016) review of research on generative learning strategies found that when students teach others, they learn more than comparison groups who do not teach others (e.g., Coleman et al. 1997; Fiorella and Mayer 2014, 2013). However, related research by Roscoe (2014) and Roscoe and Chi (2008) indicated that students tasked with teaching may simply "restate the material with minimal elaboration," and that learning benefits emerge when students go beyond rote recitation and process the material deeply. Questions from the students they are teaching can encourage such processing.

LINK: *ABSTRACT: FIORELLA AND MAYER (2016), "EIGHT WAYS TO PROMOTE GENERATIVE LEARNING"*

Jeffers students participated in other educational events supported by their hub

The LSSI's partnership with Michigan Technological University creates many opportunities.

MTU hosted two events serving Jeffers students and other regional students in 2014–15: the fourth annual Lake Superior Water Festival, and the Bioathalon.

The festival, held in September at the Great Lakes Research Center, was a half-day event that served nearly 500 high-school students from across the western Upper Peninsula, including those from Jeffers. Students participated in four breakout sessions on such topics as Great Lakes fish and wildlife, remotely operated vehicles (ROVs), invasive species, environmental monitoring, the U.S. Coast Guard, climate change, and biodiversity. Presenters came from the university, government agencies, and community-based organizations. In addition, some students served as presenters.

The Bioathalon gave high-school students an opportunity to visit campus, where they participated in a biology lecture, a biology lab, and talked with university faculty and students about careers in the biological sciences.

LINK: *WATER FESTIVAL PHOTO ALBUM ON FLICKR*
LINK: *BIOATHALON*
LINK: *LAKE SUPERIOR WATER FESTIVAL VIDEO (1 MIN)*

Students from nearby Dollar Bay High School teach peers about remotely operated underwater vehicles at the Lake Superior Water Festival. Photo courtesy of MTU.

Students use lab equipment during the Bioathalon. Photo courtesy of MTU.

Team and Planning

PBSE builds relationships that support teachers

Relationships are an important part of most PBSE efforts. Teachers can work in grade level, multidisciplinary teams on a common PBSE effort, or on teams that span grades or even schools. This does not mean that a single teacher cannot implement PBSE, just that the benefits are often greater when they can work with a team.

Teachers also form partnerships with community members who have environmental expertise or resources to share, or an ongoing community or environmental project that would benefit from the involvement of students.

Over the years that the GLSI has been operating, many teachers have said that they particularly value this opportunity to collaborate with other teachers and experts in the community.

The benefits of teacher collaboration are supported by research like *The Missing Link in School Reform*, from the Stanford Social Innovation Review.

LINK: *THE MISSING LINK IN SCHOOL REFORM*

Thirteen teachers were involved in the 2014–15 PBSE effort

Teachers, community partners, and the LSSI work together to support PBSE.

The following Jeffers Middle and High School teachers conducted PBSE efforts using the outdoor classroom in the 2014–15 school year:

- Cindy McCormick (environmental literacy)
- Jonathan Kilpela (science)
- Jen Pera (science and mathematics)
- Chuck Palosaari (history and technology)
- Cheryl Ruohonen (English/language arts and social science
- Trish Sherman (science and guidance counselor)

Additionally, these teachers participated in all-school days at Lake Perrault:

- Jason Koski (physical education and social science)
- Madeline Larson (English/language arts)
- Steven Lishinski (special education)
- Gary Miller (industrial trades)
- Morgan Raether (English/language arts and German)
- Lisa Raffaelli (mathematics)

Principal Mike Benda supported the teachers and students.

Chuck Palosaari taught history and technology during the 2014-15 school year. Follow the link below to see a brief video interview.

LINK: *INTERVIEW WITH CHUCK PALOSAARI*

Five partner organizations participated in the 2014–15 PBSE effort

The Copper Country Chapter of Trout Unlimited helped students monitor the Salmon Trout River, assisted with BioBlitz inventories and surveys, attended "all-school days" at the outdoor classroom (when all students were on site), and presented in classrooms.

The Michigan Department of Natural Resources and the **Michigan Nature Association** (MNA) own the land on which the outdoor classroom is located. Both organizations helped LSSI staff identify stewardship needs there and welcomed students' use of these sites. MNA helped with monitoring during the BioBlitz and participated in all-school days.

The Keweenaw Invasive Species Management Area participated in the BioBlitz.

Michigan Technological University (MTU) has been a long-term partner of both Jeffers High School and the LSSI. MTU provided Jeffers High School with a graduate student for the 2014–15 school year as part of its GK-12 Global Watershed Program, which partners PhD students with middle- and high-school teachers to create lesson plans and activities that translate doctoral research on watershed science topics to secondary classrooms. MTU staff also presented to students on science careers, and hosted the water festival and the Bioathalon.

Other local scientists and natural resource professionals contributed to the BioBlitz and the all-school days at Lake Perrault.

Left to right: Teacher Cindy McCormick, community partners Joan Chadde-Schumaker and Steve Brimm, and teacher Chuck Palosaari discuss logistics at the outdoor classroom.

The Adams Township School District is a supporter of PBSE

The mission of the Adams Township Public Schools is to provide a safe learning environment where all students can develop academic and personal skills necessary to function as responsible citizens in a changing world. PBSE is especially relevant to the school's mission in part because it provides students with opportunities to learn about their place and be involved in stewardship. Both are important responsibilities of community residents.

Jeffers High School has more than 200 students in seventh through 12th grades, down sharply from 2,322 K–12 students in 1918! In addition to core academic courses, Jeffers High School students have access to elective courses in greenhouse/gardening, building trades, technology (including website design), and dual-enrollment courses through MTU and Gogebic Community College.

Middle- and high-school students have worked with the LSSI since the hub's inception in 2008. While the nature and extent of students' involvement varies each year, the stewardship of Lake Perrault and the Brown Nature Sanctuary is woven into the curriculum.

The district's administrative policies and practices help teachers succeed with PBSE

Although PBSE is a schoolwide strategy at Jeffers, its successful execution by teachers depends on strong district support. To that end, the school superintendent provides all classes with an unlimited number of field trips to Lake Perrault and the Brown Sanctuary.

School administrators encourage teachers to design their own PBSE professional development (PD), which has included an Earth Force workshop on the role of students in designing and executing PBSE (offered districtwide for K–12 teachers); presentations by experts in ethnobotany and the environmental monitoring of climate change; and strategies for engaging students in outdoor learning.

Participating teachers or administrators at the school provide the district's school board with monthly updates about PBSE-related work. This builds the board's awareness and keeps communication channels open.

The work described in this case study has stood the test of time. Since the effort began, the lead teacher has changed three times, and there has been a 50 percent teaching staff turnover in the middle and high school. In spite of these changes, the work has continued to develop.

Professional development facilitated by the hub focuses on content about the Great Lakes (and their ecosystems) and environmental stewardship. It also provides time for teachers to discuss ways to integrate this content into their curriculum through PBSE.

***Guiding Principle 3e:* PBSE informs, enhances, and supports school and district priorities related to curriculum and school improvement.**

Teachers play a lead role in planning for PBSE

Staff at Jeffers Middle and High Schools work together to plan and implement classroom and community-based learning.

Teachers, administrators, and other staff at Jeffers are very involved in planning for PBSE. In the 2014–15 school year, teachers regularly shared resources and worked together during staff meetings and informal gatherings to organize and coordinate the PBSE efforts within the school district. Jeffers High School teachers tended to work independently to address learning goals for their individual classes, while Jeffers Middle School teachers spent more time developing integrated, cross-curricular opportunities for students, both in the classroom and in the field.

One person led most of the planning for the fall and spring all-school days, which involved recruiting and scheduling guest presenters. However, all participating teachers provided additional help in planning and facilitating those events.

Planning also involved community partners. The Michigan Nature Association and the Michigan Department of Natural Resources, which own the property that students studied, helped decide what visitors should learn or experience while visiting Lake Perrault and the Brown Nature Sanctuary.

Teachers participate in a five-day summer institute focused on helping students design their own authentic research projects.

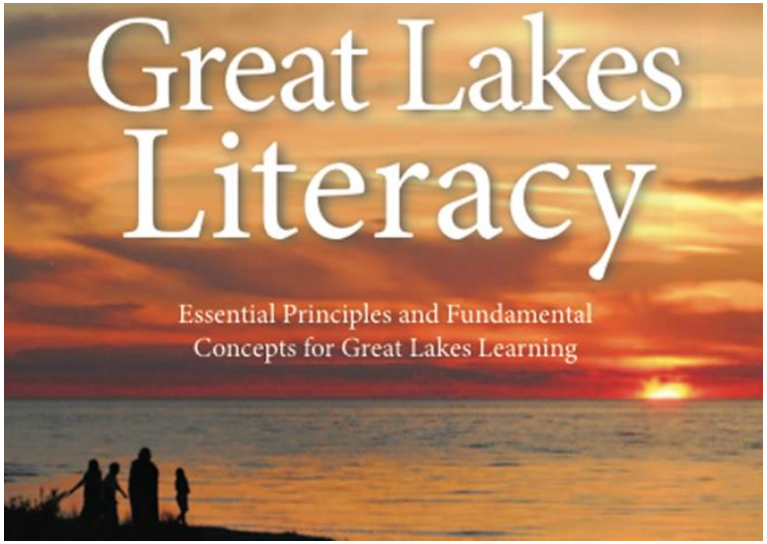
The LSSI requires the teams it supports to address the Great Lakes Literacy Principles

This expectation brings focus to project planning and creates shared experiences for the many schools and teams involved with the hub.

Developed in 2009 by a network of committed educators and scientists affiliated with the Sea Grant system, the Great Lakes Literacy Principles identify the concepts that students, teachers, and residents of the region need to understand about the Great Lakes. Jeffers High School students are exposed to many of the Great Lakes Literacy Principles through their PBSE work.

LINK: *THE GREAT LAKES LITERACY PRINCIPLES*

LINK: *RELATED TEACHING RESOURCES*



The Great Lakes Literacy Principles brochure cover.

Example links between the Lake Perrault Outdoor Classroom and Stewardship Project and the Great Lakes Literacy Principles

Principle 1. The Great Lakes, bodies of fresh water with many features, are connected to each other and to the world ocean.

The interconnections of Great Lakes waters are explored in stream monitoring on Salmon Trout River and Otter Creek.

Principle 4. Water makes Earth habitable; fresh water sustains life on land.

Students sample water from a fen, bog, inland lake, and Lake Superior, and compare data.

Principle 5. The Great Lakes support a broad diversity of life and ecosystems.

The BioBlitz results in collection of data on numerous, diverse life forms in the area.

Impacts of the Project

PBSE offers deep learning and community enhancement

One of the key principles of PBSE is that when students are able to create tangible, meaningful benefits for the community and the environment through their own efforts, they benefit academically. Not “either or,” but “both and.”

This win-win quality of PBSE makes it particularly attractive when resources for community and environmental enhancement are scarce, and when schools are challenged to meet new, higher expectations for student learning.

Involving students in their communities makes learning more relevant and engaging. Students are intrinsically motivated to learn when the work is interesting and consequential.

Students participating in PBSE efforts supported by the U.S. EPA grant to the Great Lakes Stewardship Initiative participated in pre- and postexperience surveys, pre- and postexperience tests, and other data-collection efforts to document their responses to these opportunities. Teachers had some choices to make regarding the subject matter of tests (Great Lakes or general ecological literacy).

This section explores the benefits to the Painesdale community and environment achieved through PBSE at Jeffers High School. It also reviews selected findings regarding student impacts.

Students improved public access and education at Lake Perrault and the Brown Nature Sanctuary

Research indicates that when students deliver tangible, meaningful community benefits, they are more engaged.

The benefits of spending time outdoors are well documented. Yet in recent years, the average American adult and child are spending very little time there.

Over the years, Jeffers students have cleared and marked trails, and constructed and installed a bridge, a boardwalk, a viewing platform, and a kiosk to distribute informational materials. These modifications have substantially enhanced the quality of public access and education at these sites.

Visitors enjoy the 1.5 mile-long trail that Jeffers High School students created, which encircles Lake Perrault.

Students reinforce a section of a viewing platform.

***Guiding Principle 6*: Deliver meaningful benefits to the local environment and the community through PBSE.**

While expanding public access, Jeffers students protected fragile ecosystems

Students at Jeffers High School built trails and structures that encourage people to explore and appreciate Lake Perrault and the Brown Nature Sanctuary. They used building strategies that protect the lake's shoreline, fragile wetland habitats, and unusual plants and animals.

This boardwalk and platform improve access and enjoyment for visitors. Both are elevated in order to protect the plants beneath and to avoid creating barriers to the movements of small animals.

The rose pogonia (or snakemouth orchid) is a fragile plant that is native to Michigan and found in the Brown Nature Sanctuary.

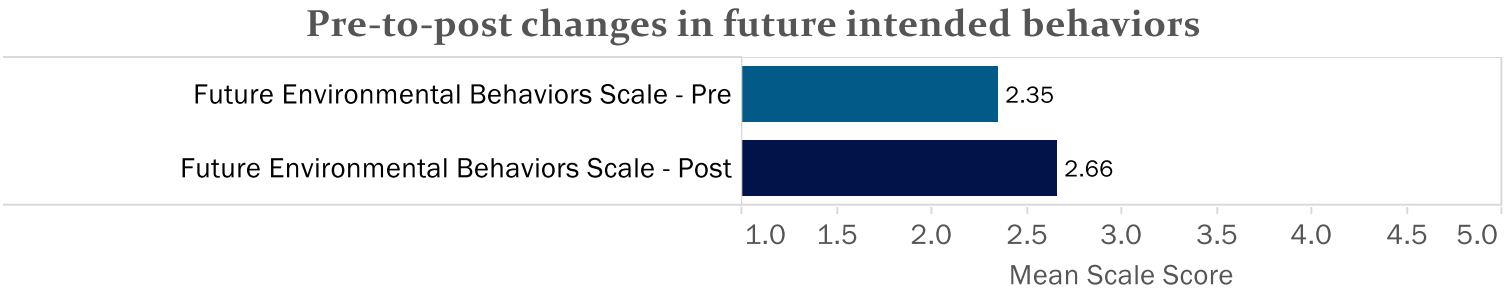
“The kids understand now there is a reason to protect this place. The stewardship part of it is their obligation to keep this place the way it is now for future generations.”

—Mike Benda, Jeffers High School Principal

LINK: *VIDEO OF MIKE BENDA ON STEWARDSHIP*

High-school students responding to the student survey exhibited growth in intentions to protect the environment in the future

Scores in the postexperience survey were compared to those in the preexperience survey.



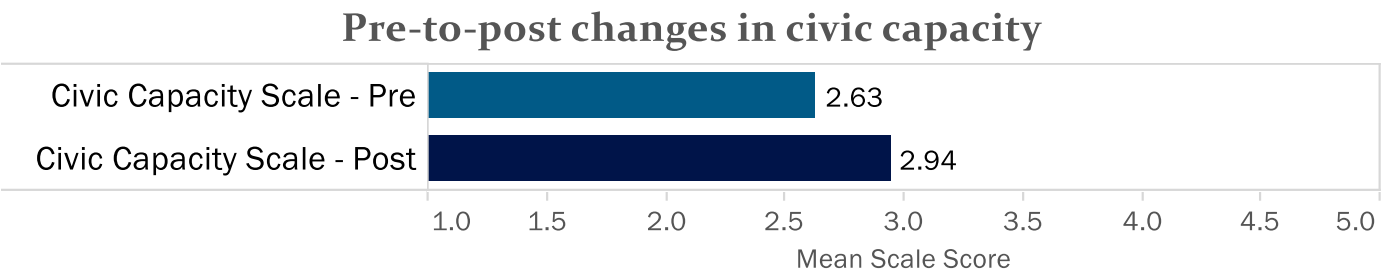
Students taking the survey were presented with a list of actions and asked, "When you think about life after school, how likely is it that you would do these things?" (Flanagan, Syvertsen, and Stout 2007, citing Kahne, Middaugh, and Schutjer-Mance 2005). Students self-assessed, for each action, on a scale of 1 (not at all likely) to 5 (very likely). The actions were:

- Donate money to an environmental group or cause.
- Work with others to solve an environmental problem in the community where you live.
- Consider the environmental position of candidates for public office when voting.
- Buy environmentally friendly detergents and cleaners, even if they cost more.
- Compost your household food waste.
- Talk with others about their behaviors that are harming the environment.
- Speak to your supervisor about ways to reduce harmful environmental impacts of the company or place you work for.

The item scores were combined into a single composite score representing the average of the 1-to-5 responses to the individual items.

Students' mean score on the scale was 2.66 at the end of the year, after their PBSE, and 2.35 at the time of the initial survey. The difference of +0.31 is an increase of 0.48 standard deviations, a moderate effect.

Middle-school students responding to the survey exhibited increases in their self-assessed civic capacity



Students taking the survey were asked how well they would be able to perform various civic actions if there was an environmental problem they wanted to do something about. Students self-assessed, for each action, on a scale of 1 (I definitely can't) to 5 (I definitely can). The middle-school items were:

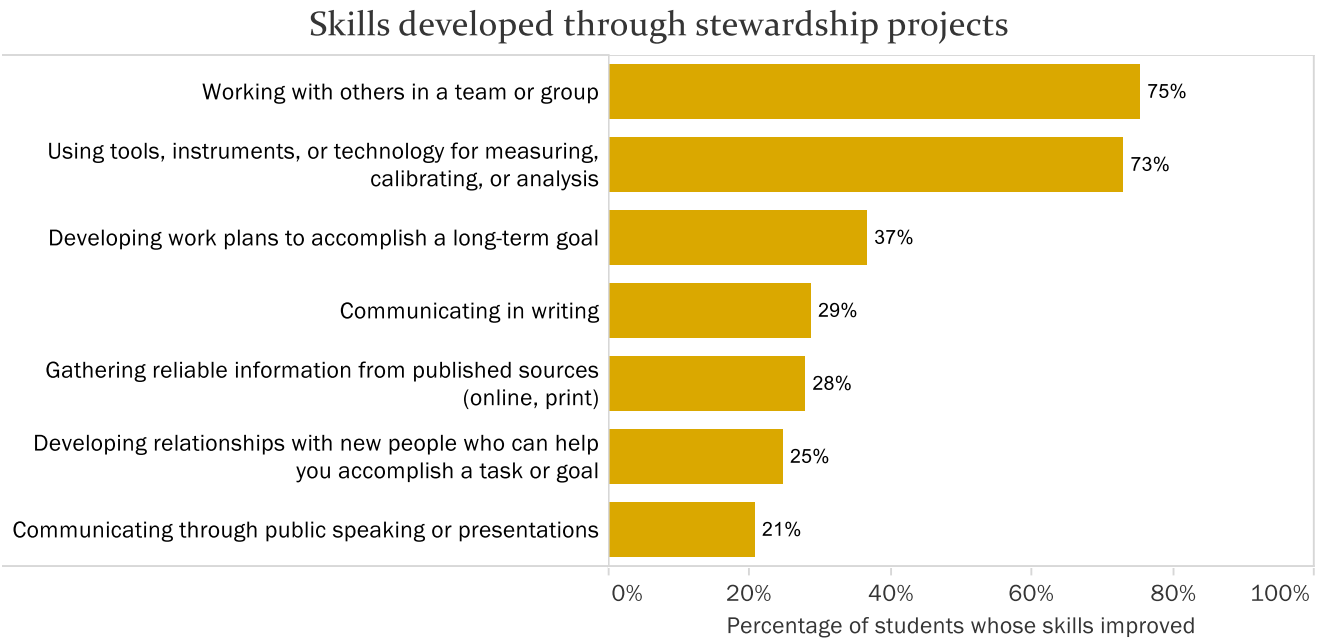
- Gather data and information to describe the nature and extent of the problem.
- Get other people to care about the problem
- Express your views in front of a group of people.
- Identify individuals or groups who could help you with the problem.
- Write an opinion letter to a local newspaper.
- Call someone on the phone that you had never met before to get their help with the problem.
- Create a plan to address the problem (Flanagan, Syvertsen, and Stout 2007, citing Kahne, Middaugh, and Schutjer-Mance 2005).

The item scores were combined into a single composite score representing the average of the 1-to-5 responses to the individual items.

Students' mean score on the scale was 2.94 at the end of the year, after their PBSE, and 2.63 at the time of the initial survey. The difference of +0.31 is an increase of 0.43 standard deviations, a moderate effect.

Students at the middle- and high-school levels reported improvements in their professional skills

About 75 percent of surveyed students reported improvements in their teamwork and technology skills.



Students were presented with a list of professional skills and asked to identify any that they felt were developed through their PBSE effort. Most Jeffers students indicated that the PBSE work improved their ability to work with others in a team or group. Most responding students also indicated that they enhanced their skills for using tools, instruments, or technology for measuring, calibration, or analysis.

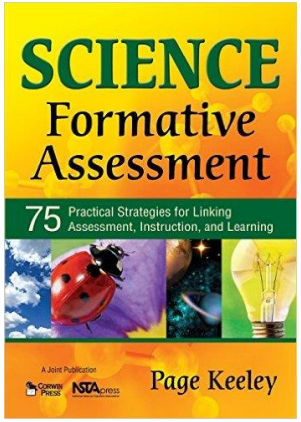
Students indeed used a variety of technological tools to collect, interpret, and share the data they gathered during field activities. These tools included Vernier Probeware, Google Drive, GPS units, Android devices, and website development software.

Students began the year with several misconceptions about the environment and its care

As part of the evaluation for the GLSI's U.S. EPA grant, students at Jeffers High School completed a worksheet with three prompts:

- "I used to think"
- "Now I know"
- "This is how I learned it"

Students were instructed to focus their answers on environmental stewardship. Because Jeffers teachers used the outdoor classroom to teach a number of different lessons, students' responses varied by classroom, and tend to reflect the unique learning goals their teachers pursued at Lake Perrault and the Brown Nature Sanctuary.



The worksheet prompts were derived from a formative assessment in this 2008 text.

LINK: *SCIENCE FORMATIVE ASSESSMENT: 75 PRACTICAL STRATEGIES FOR LINKING ASSESSMENT, INSTRUCTION, AND LEARNING*

What students used to think about stewardship and the natural environment:

- Vernal pools are just unremarkable puddles
- Litter doesn't cause any harm
- Clear cutting is the best way to harvest lumber
- Natural waters are all chemically the same
- Environmental stewardship is:
    - Boring
    - Not for kids to do
    - Unimportant
    - A feeling one has about the environment
- Lake Superior benefits animals but not humans; Lake Superior can't be polluted
- People's behaviors in nature don't affect animals that live there
- It doesn't matter where you walk in the woods
- Frogs and salamanders live in lakes and ponds (but not at Lake Perrault)

Students ended the year with a deeper understanding of their study sites and of stewardship

What students now know about stewardship and the natural environment:

- "Every puddle is teeming with life and has its own ecosystem."
- "These puddles are specific small life habitats called vernal pools. They help aid in the birth and surviving for such small animals during the spring from ground and snow melt water."
- "Now I know that you should manage the forests and only cut down a couple [trees] at a time."
- "Water varies from a bunch of different PH balances around 7."
- "Now I know that caring about the environment is … important. Even if there are a lot of people doing it, one more person would be even better because the more people that are caring for the Great Lakes, the better for them and the better for the things living in them. We all depend on the Great Lakes."
- "Now I know that you can't just want it, you have to go out and actually do something to help."
- "Stewardship is something that everyone can participate in."
- "Now I know a lake is part of society. It can be used as an energy source, transportation, a food source, education, etc."
- "Now I know that walking on the fen's soft ground can destroy the habitats of the animals that live there. I learned about the fragile ground at the bog and fen from our teacher's explaining why the boardwalk is there."
- "I used to think that frogs lived in dry areas. But now I know that they live in wet, moist areas. I learned this today at Lake Perrault. We went frog/salamander hunting and we found more by the wet areas."

Other PBSE efforts could yield a different set of benefits

There is a lot of freedom within the PBSE framework, so many benefits are possible depending on the direction taken.

BENEFITS OF PLACE-BASED STEWARDSHIP EDUCATION CAN INCLUDE:

STUDENT ACADEMIC GAINS

- Improved academic scores and grades
- Improved critical thinking skills
- Increased engagement in school and motivation for achievement
- Increased professional skills, such as leadership, persistence, taking responsibility, teamwork, developing plans to reach a solution, managing time, motivating others, and dealing with unexpected challenges
- Deeper learning and action competence
- Increased awareness of career options

POSITIVE YOUTH DEVELOPMENT AND STEWARDSHIP GAINS

- Social-emotional development, including increases in self-esteem, a sense of empowerment and agency, social interaction skills and capital, and awareness of cultural diversity
- Sense of place and community attachment
- Civic-democratic competencies and attributes
- Pro-environmental attitudes
- Environmental sensitivity and awareness
- Responsible environmental behaviors

TEACHER BENEFITS

- Opportunity to pursue their interests and advance their values
- Skill development
- Motivated students

SCHOOL AND DISTRICT BENEFITS

- Teacher engagement and satisfaction
- An integrated option to reach numerous and robust standards and curricular priorities as well as youth development priorities
- Increased awareness from the community of the conditions, needs, and efforts of the schools
- Stronger connections with community-based organizations, parents, and individual community members
- Access to grants, funders, and recognition

PARTNER ORGANIZATION BENEFITS

- Engaged youth and schools in their work
- Raised awareness of the mission
- Increased capacity
- Networks with other organizations in the field
- Access to grants, funders, and recognition

LOCAL BENEFITS

- Community revitalization and environmental improvements
- Sense of place
- Social capital and community capacity

IMPACTS

Support from the Hub

The GLSI works through regional hubs

Regional hubs implement the GLSI's three core strategies—they deliver professional development for PBSE educators, foster partnership between schools and communities, and provide direct support for PBSE experiences.

The GLSI currently has nine regional hubs throughout Michigan. Some work with predominantly rural communities, some with urban communities, and some with various communities that span the urban-rural continuum.

Hubs have the local knowledge and relationships needed to adapt the strategies to the needs and culture of the local area. The Lake Superior Stewardship Initiative is the GLSI regional hub that supported the work described in this case study.

LINK: *GREAT LAKES STEWARDSHIP INITIATIVE*

The Lake Superior Stewardship Initiative serves the Western Upper Peninsula

Established in 2008, the Lake Superior Stewardship Initiative brings together schools and community partners to prepare K–12 students to become knowledgeable citizens concerned about the Lake Superior watershed and actively engaged in stewardship projects in their community.

- The LSSI implements place-based curricula in the classroom that engages students in learning about their community, cultural heritage, local watershed, and the Great Lakes.
- The LSSI provides PD for teachers and programming for students that increase content knowledge about the Great Lakes and provide opportunities to visit and learn about Lake Superior, its tributaries, local wetlands and forests, and other outdoor environments in their communities.
- The LSSI develops school-community partnerships with local units of government and community organizations. Students, teachers, and partners collaborate to address local stewardship needs through place-based stewardship projects.

LINK: *LAKE SUPERIOR STEWARDSHIP INITIATIVE*

LINK: *LSSI VIDEO*

LAKE SUPERIOR
STEWARDSHIP INITIATIVE

"Connecting schools and communities in the stewardship of Lake Superior and its watershed"

Hubs implement three core strategies for stewardship

Each GLSI hub provides a program of sustained professional development, brokers school-community partnerships, and supports place-based education. Their strategies are not inherently tied to environmental stewardship—that theme and content must be infused into each aspect of the work.

The GLSI's hubs have developed approaches that reflect the environmental character and needs of their respective communities, the interests and goals of their school districts, the strengths of the hub staff and the host organization, and the mix of community organizations engaged in stewardship work with youth.

Every hub shapes their strategies to meet the needs of its people and places.

SUSTAINED PROFESSIONAL DEVELOPMENT

A program of ongoing learning, building teaching skills and content knowledge for PBSE over a period of months or years, and forging a community of learners.

PLACE-BASED EDUCATION

A hands-on, inquiry-based, contextually embedded, and community-supported approach to teaching and learning that occurs in and with a place or community, is about a place or community, and yields benefits for a place or community.

SCHOOL-COMMUNITY PARTNERSHIPS

Teachers, students, and representatives of community organizations collaborate on projects to improve the community and environment, meeting grade level learning expectations through these efforts.

SUPPORT FROM THE HUB

The LSSI provides sustained professional development for teachers

The LSSI conducts biennial surveys to assess teachers' PD interests and needs, and then uses the data for planning purposes. The LSSI honors teachers by continually striving to meet their needs in the areas of content, skills, and pedagogy.

PD occurs throughout the school year and may be led by the LSSI's staff, by participating teachers, or by staff of other organizations that collaborate with the LSSI. An example of the latter is PD offered by Earth Force's staff as part of a collaborative project involving Earth Force, the LSSI, and the GLSI. This PD helped teachers integrate student voice into the design and execution of stewardship projects.

In addition, teachers can benefit from hearing from and working with content experts in the field. This builds teachers' confidence and inspires them.

The LSSI recognizes that teachers are a rich source of support for each other, so the hub provides both time and structure for them to share their experiences and work together to solve problems.

Teachers identify and map key features of Lake Superior's watershed.

> ***"The LSSI has provided excellent professional development opportunities for our team … We could not do this work without the professional development support from the LSSI."***
>
> ***—Cindy McCormick, Jeffers High School English teacher***

The LSSI supports professional learning communities

Teachers in PLCs have studied environmental books and films, hosted technology workshops, and trained each other to conduct outdoor lessons.

The graphic word cloud shows the varied topics PLCs have studied.

The professional learning community (PLC) protocol was tested by the LSSI as part of a 2012 National Oceanic and Atmospheric Administration (NOAA) B-WET grant. PLCs proved to be an effective way to strengthen teams and to advance teacher education with the goal of improving student learning. The LSSI has required its participating schools to operate PLCs (as a condition for receiving mini-grants) since 2013.

PLCs meet a minimum of three times for a total of at least 12 hours, and involve three or more participants. Topics are selected as a result of a needs survey conducted at the school level and have included schoolwide in-services, book and film studies, teacher-led technology workshops, and lesson development for outdoor learning experiences. Meetings take place on or off campus, at a time that Is most convenient for participants.

PLCs are based at individual schools and reflect the needs and culture of those schools.

An inclusive advisory group guides the work of the hub

Key stakeholders help the hub develop future plans, solve problems, and award two-year grants for PBSE projects.

Quality PBSE actively engages students, teachers, and partners in purposeful work to address recognized local stewardship needs or opportunities.

Proposals for place-based stewardship projects are submitted by school teams that comprise at least two teachers, one administrator, and at least one community partner. All projects must focus on a community stewardship need, address at least one school improvement goal, and have clear connections to the school's curriculum.

Students, teachers, and partners share in the responsibility to manage their time and resources to ensure that intended outcomes are achieved.

The LSSI Advisory Board reviews applications for mini-grant proposals submitted by school-based teams, and offers suggestions to improve the proposals. This feedback is designed to help teachers develop their capacity to secure funding for future work.

The LSSI has played a key role in advancing PBSE in Jeffers High School

For Jeffers High School, the hub has facilitated PD for teachers, obtained equipment and supplies for stream monitoring and frog deformity surveys, connected Jeffers High School teachers to community partners, written grants to help fund the first BioBlitz and an afterschool class focused on outdoor investigations, conducted a survey of teachers' PD needs, conducted a districtwide Earth Force workshop, and helped organize and offer public events associated with students' work at Lake Perrault and the Brown Nature Sanctuary.

The hub's work with the school has added to the hub's experience with PBSE and helped to build hub capacity to work effectively with other schools and communities in the western Upper Peninsula.

"To be able to supplement place-based education with the help of the community investors allows this district to provide a meaningful educational experience to students."

—Tim Keteri, Adams Township Schools Superintendent

Looking Forward

Over the course of many years, a team will develop PBSE experiences, skills, and sustainability strategies

The PBSE work at Jeffers High School started with far more limited efforts than are outlined in this case study; the work has since evolved. Many teachers have now been involved for years; some are newer to the school than others. Similarly, the partnerships shown in this study are at various stages in their development. Personnel change is an ongoing fact of life in education and in nonprofit and municipal organizations, so any ongoing PBSE effort must expect to continuously orient new team members to the work.

Even though the path forward is not always linear, experience is a real asset. Some researchers who have considered the stages an educator passes through in adopting a new educational strategy like PBSE have developed models to describe the process. One such model, the concerns-based adoption model, describes an evolution of concerns, a change from personal concerns ("How will this affect my routine?") to those about impact and expansion ("How will this affect students? How can I share ideas with other teachers?").

Experience creates capacity to think about how PBSE benefits students, teachers, and community, and how it might be enhanced and better supported.

LINK: *CONCERNS-BASED ADOPTION MODEL*

Jeffers teachers envision a gradual expansion of PBSE and a greater emphasis on multidisciplinary work

Existing projects will continue as the foundation of PBSE.

Jeffers High School students and teachers will continue the existing projects at Lake Perrault, including ongoing construction and improvements to the nature trail, monitoring and removing invasive species, and holding a BioBlitz each fall and a place-based learning day each spring.

New subject matters to be explored through PBSE may include greenhouses, green landscaping, local food, and additional ways to use technology to monitor water quality. Teachers also want to expand outdoor education to include other areas at and near the school, including a stream behind the school and a poor-rock pile and old mine dump nearby.

Teachers at Jeffers High School also plan to continue efforts to integrate place-based education across the curriculum, and to incorporate into their practice teaching strategies that develop and embrace student voice in the planning and execution of PBSE projects.

Students view the kiosk they built at the outdoor classroom.

"We want our students to get hands-on with their environment in every class."

—Chuck Palosaari, teacher

Everyone involved has learned lessons along the way

Teacher participants in this project reflected on the work they did and identified some important lessons that they learned. These included:

- Engage students in real work. (See GLSI Guiding Principle 6, reviewed on page 45)
- Invite community experts for only part of a day, to ensure a better turnout.
- Give students a participation grade for taking part in public events associated with the project.
- Engage students in a fun outdoor activity at the start of the school year before introducing the project to a new class.
- Don't over-plan; be open to opportunities that may emerge. (See GLSI Guiding Principle 3d, this page)

Using the two sites for teaching is a practice that is continually evaluated and refined by Jeffers High School's staff. Teacher leaders at Jeffers High School encourage and support those members of the staff that are new to using Lake Perrault and the Brown Nature Sanctuary for their own classes. These veterans recognize that one of the biggest challenges they faced early on—particularly for inexperienced teachers—is changing one's mindset and believing that the curriculum can be taught outdoors.

Today's young children, whose awareness of nature is just budding, might be tomorrow's passionate stewards of the environment.

Guiding Principle 3d: **Establish clear but flexible learning goals that relate to robust standards for student achievement.**

For More Information

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Lake Superior Stewardship Initiative

Copper Country ISD Supporting a Lifetime of Learning

Trout Unlimited

Great Lakes Stewardship Initiative
Expanding classrooms. Strengthening communities.

FOR MORE INFORMATION

About the Great Lakes Stewardship Initiative

The Great Lakes Stewardship Initiative was launched in 2007 to develop knowledgeable and active stewards of the Great Lakes and their ecosystems.

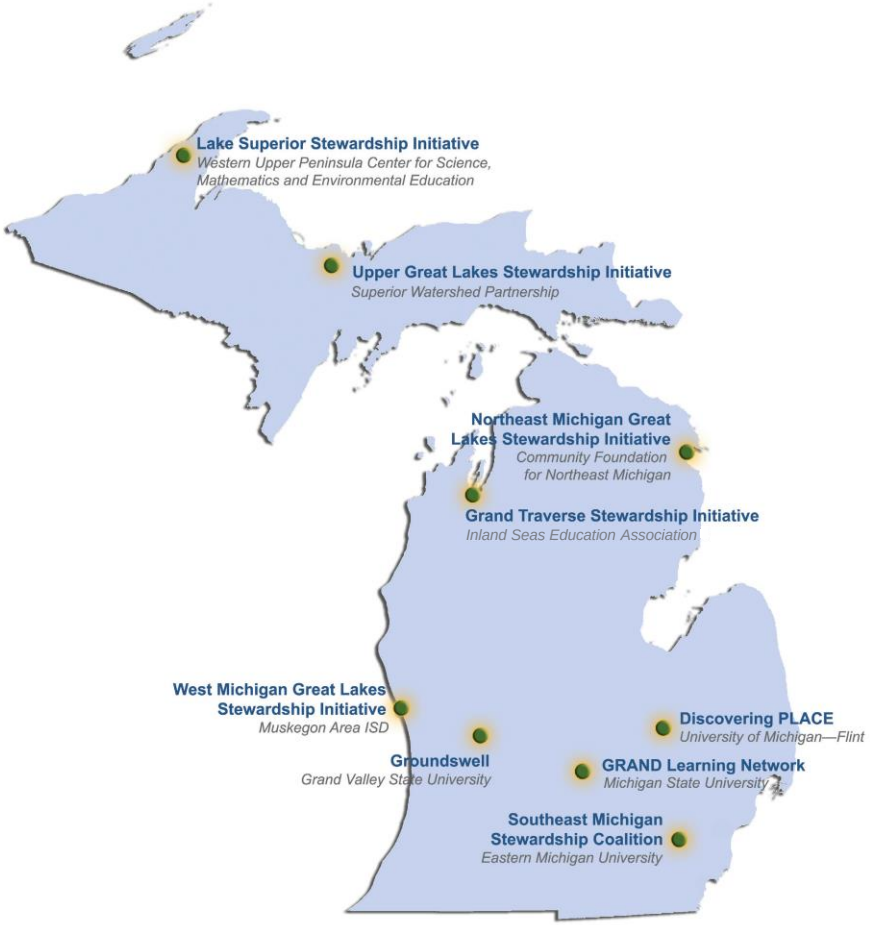
The GLSI enacts three key strategies (place-based stewardship education, sustained professional development, and school-community partnerships), mainly through the efforts of its nine regional hubs. A small central staff helps coordinate the work and provides technical assistance and support to hubs.

Hubs are funded, in part, by the Great Lakes Fishery Trust, which in 2007 pledged to provide more than $10 million through 2017 to support the GLSI's work. The GLSI and its hubs solicit and receive additional support from foundations, federal and state agencies, local and regional partners, and individual donors.

From 2007 through the 2014–15 school year, the GLSI has worked with more than 1,500 teachers in more than 280 schools across Michigan, engaged hundreds of community partners, and supported rigorous place-based stewardship experiences for more than 80,000 students—and the work continues.

LINK: GREAT LAKES STEWARDSHIP INITIATIVE

LINK: GREAT LAKES FISHERY TRUST



FOR MORE INFORMATION

The GLSI's 2014 grant from the U. S. Environmental Protection Agency supported this case study and other knowledge products

In 2014, the U.S. EPA awarded the GLSI a $150,000 grant through its Environmental Education Grant Program. Through this grant, the GLSI funded a collection of exemplary place-based stewardship projects across Michigan and documented these projects through case studies.

The grant also supported the development of several knowledge products to support the practice and spread of place-based stewardship education in K–12 schools and communities. The first knowledge product is a set of guiding principles that describes the GLSI's vision for place-based stewardship education in K–12 schools and communities. The principles can serve as a compass for practitioners, and also highlight the ways that place-based education connects to important goals and initiatives in education.

The second knowledge product is a rubric that supports the guiding principles. The rubric describes in detail the actions and practices that characterize various developmental stages in place-based stewardship education. It can be used for several important purposes, including a self-assessment of practice.

A third knowledge product is a white paper that focuses on expectations for and the educational, community, and environmental benefits of place-based stewardship education across urban, rural, and suburban contexts.

This document was developed under Assistant Agreement No. 00E01327-0 awarded by the U.S. Environmental Protection Agency. It has not been formally reviewed by EPA. The views expressed are solely those of the Great Lakes Fishery Trust and EPA does not endorse any products or commercial services mentioned.

LINK: OTHER GLSI KNOWLEDGE PRODUCTS

LINK: FULL SET OF GLSI CASE STUDIES

United States Environmental Protection Agency

FOR MORE INFORMATION

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GREAT LAKES
Stewardship Initiative

With assistance from participating educators, civic leaders, and community partners, the GLSI:

- Helps young people become effective and motivated environmental stewards
- Encourages schools and community organizations to work together for mutual benefit
- Creates a sustained effort across Michigan to expand classrooms, strengthen communities, and improve the environment