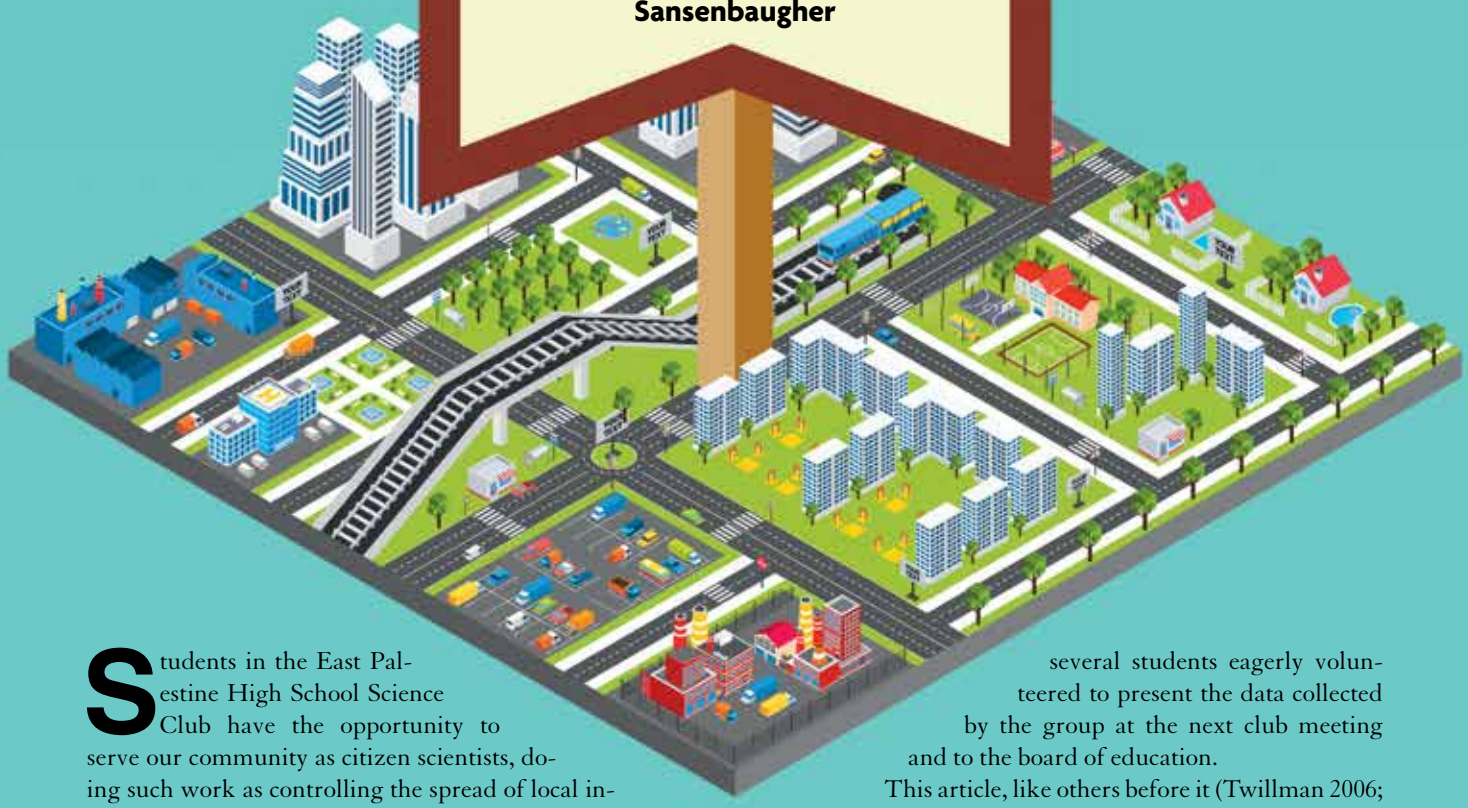
START A SCIENCE CLUB

Create citizen scientists while teaching content and helping your community

Lisa Bircher and Bonnie Sansenbaugher



Students in the East Palestine High School Science Club have the opportunity to serve our community as citizen scientists, doing such work as controlling the spread of local invasive plant species, participating in coastal cleanups and data collection, and monitoring water quality using a device called the Hydrolab in local streams and lakes.

On our club's first field trip, to Erie, Pennsylvania, 30 students boarded Gannon University's Lake Erie research vessel, the *Environaut,* for a science cruise. After the cruise, students helped remove invasive weed species at Presque Isle State Park on a Lake Erie peninsula with tools and safety equipment provided by the park staff. On the bus trip home, several students eagerly volunteered to present the data collected by the group at the next club meeting and to the board of education.

This article, like others before it (Twillman 2006; Scheman, Frankel, and Davis 2001; Beckrich 2011; Simmons et al. 2003), describes the benefits of high school science clubs, focusing on forging partnerships with local and regional organizations; the importance of a service-learning component (Jones et al. 2012; Bennett 2010; Sega 2008); and how local science club activities bring students and community members together. We also address how we can improve the work of the group to make science accessible to all our high school students.

FIGURE 1

East Palestine High School Science Club partnerships.

Partner	Support provided
PA, IL-IN, OH Sea Grant	Monthly contact for discussion and brainstorming, Hydrolab (on loan), funding for field trips and service-learning projects
Gannon University (Erie, PA)	Support from Dr. Steve Mauro for supplemental instruction on water quality testing (E.coli, triclosan, etc.) and funding for *R/V Environaut* field trip
Nash Foundation (East Palestine, OH)	Funding for field trips and outdoor education area materials
Camp Frederick (Rogers, OH)	Physical space for water quality testing, counselor training for Science Camp, recreation and team-building
Beaver Creek State Park (OH)	Local watershed education, field trip and supplemental learning about life in the watershed ecosystem
Columbiana County (OH) Soil and Water Conservation District	Assistance with water quality testing via macroinvertebrate stream quality monitoring

Partnerships

At a summer workshop, we learned of the benefits of having students take ownership of a local watershed-based issue and creating a service-learning project (McDonald and Kromer 2005; Leege and Cawthorn 2008; Neeper and Dymond 2012). At the workshop, we established a partnership with Sea Grant (see "On the web") and began identifying potential local partnerships to support our Science Club (Figure 1)—thinking globally but acting very locally. Most organizations were eager to help, and partnerships materialized literally overnight. The process was as simple as describing our intentions and needs and then asking for support.

Service-learning

We want our students to experience learning and doing science as they give back to the community. In our first year, our Science Club service-learning projects included invasive species removal, the International Coastal Cleanup, and development of the 48-acre woodland located on our school campus.

In the woodland, stands of the invasive species garlic mustard quickly out-compete local flora, changing the structure of plant communities on the forest floor. Students pulled the garlic mustard out by the roots before it went to seed (Figure 2). The plants were bagged and removed before they could reproduce and spread even more. Students were instructed on how invasive species crowd out native plants.

The Ocean Conservancy has encouraged groups to clean up shorelines since 1986 (see "On the web"); today, cleanups are made by hundreds of thousands of volunteers worldwide. The idea is to reduce the amount of trash that enters the oceans by cleaning up local beaches and waterways. Our science club removed trash from the waterway running through our school woodland (Figures 3 and 4), quantifying the trash and submitting our data to the International Coastal Cleanup project, which helps students recognize the sources of pollution and behaviors that lead to pollution and perhaps helps change attitudes that create pollution.

Our students find this activity inspiring and satisfying, knowing they are making a small difference in an important global problem. Students are careful with data collection and have been found to be just as accurate when trained in data

FIGURE 2

A student removes an invasive garlic mustard plant from school grounds.

ALL PHOTOS BY LISA BIRCHER

FIGURE 3

Science club students engage in the International Coastal Cleanup project.

FIGURE 4

Debris collected in East Palestine Science Club's 2014 International Coastal Cleanup.

collection as professionals (Fogleman and Curran 2008). As we tabulated the results, we were astounded by the amount, 107 kilograms (236 pounds), of debris we cleared from an isolated wooded area (Figure 5).

Note: Survey the area in advance to identify potential hazards and require appropriate personal protective equipment such as safety goggles and gloves. Caution students to avoid contact with potentially hazardous materials; students working on or near water should wear personal flotation devices. (See the NSTA white paper, Field Trip Safety, "On the web.")

Community connections

Our school woodland was convenient for service-learning projects because activities could be completed within an average class period. We know our adjacent woodland is uncommon, but many if not most schools can find local parks, camps, woodlots, or other public spaces that would be suitable. Most landowners or public property managers should be eager to have a high school science club conduct a cleanup, remove invasive species, or assist in a project of concern.

Our work in the school woodland was written about in the local newspaper, state newsletters, and the national NOAA website (see "On the web"). Students were thrilled with the coverage, which also drew more community partners. Last spring we built a trailhead into the woodland with the help of community volunteers and other interested students who eventually joined our Science Club. Last fall we acquired three picnic tables to serve as a gathering and demonstration area and with local financial support, we bought signs and held a public dedication of the area.

In the school woodland and other areas nearby we have used the Hydrolab (Figure 6, p. 42; also see "On the web"),

FIGURE 5

Summary of data collected in East Palestine Science Club's 2013 International Coastal Cleanup.

TOTAL ITEMS COLLECTED (compiled from all the student data cards)

Fast food, beach-goers, sports/games, festivals, litter from streets/storm drains, etc.

22 Bags (Paper) – mostly pieces	23 Cups, Plates, Forks, Knives, Spoons
111 Bags (Plastic) – mostly pieces	59 Food Wrappers/Containers
2 Balloons	1 Pull Tabs
67 Beverage Bottles Plastic 2liters or less	___ 6-Pack Holders
163 Glass Beverage Bottles (mostly broken pieces)	4 Shotgun Shells/Wadding
87 Beverage Cans	6 Straws, Stirrers
28 Caps, Lids	34 Toys
17 Clothing, Shoes	

Debris from recreational/commercial fishing and boat/vessel operations

___ Bait Containers/Packaging	___ Fishing Nets
___ Bleach/Cleaner Bottles	7 Light Bulbs/Tubes
___ Buoys/Floats	___ Oil/Lube Bottles
___ Crab/Lobster/Fish Traps	___ Pallets
___ Crates	29 Plastic Sheeting/Tarps
___ Fishing Line	___ Rope
___ Fishing Lures/Light Sticks	2 Strapping Bands
	4 Golf balls
	2 Fireworks

Smoking Related Activities

1 Cigarettes/Cigarette Filters	2 Cigar Tips
4 Cigarette Lighters	___ Tobacco Packaging/Wrappers
	1 pipe

Dumping Activities

4 Appliances- refrigerators/washers/etc.	___ Cars/Car Parts
1 Batteries	___ 55-Gal. Drums
20 Building Materials	___ Tires
	3 chicken wire

Medical/Personal Hygiene

___ Condoms	___ Syringes
___ Diapers	1 Tampons/Tampon Applicators
	1 Bandaid

3 other items found that concern you

4
2 Combs
1 necklace
1 Swing seat
2 styrofoam
2 nail polish

FIGURE 6

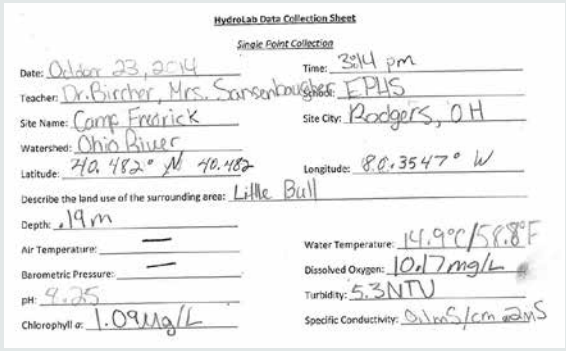
Preparing the Hydrolab.

FIGURE 7

Deploying the Hydrolab in East Palestine's City Lake.

FIGURE 8

Hydrolab data collection sheet.



HydroLab Data Collection Sheet

Single Point Collection

Date: October 23, 2014 Time: 3:14 pm

Teacher: Dr. Bircher, Mrs. Sarsenbough School: EPHS

Site Name: Camp Fredrick Site City: Rodgers, OH

Watershed: Ohio River

Latitude: 40.482° N 40.482 Longitude: 80.3547° W

Describe the land use of the surrounding area: Little Bull

Depth: .19m

Air Temperature: —

Barometric Pressure: —

pH: 9.25

Chlorophyll a: 1.09ug/L

Water Temperature: 14.9°C/58.8°F

Dissolved Oxygen: 10.17mg/L

Turbidity: 5.3NTU

Specific Conductivity: 0.1mS/cm 2mS

a device with multiple sensors that simultaneously collect data measurements related to water quality, such as pH, dissolved oxygen, water temperature, specific conductivity, turbidity, and chlorophyll levels. The collected data allow Science Club members to assess and discuss the overall quality of water in our local watershed (Figures 7 and 8). Comparing our Hydrolab data to that of other locales available online, we found that our local water quality is fairly good and human impact in our watershed is minimal. We have used class time, flex time, and extracurricular time to collect and analyze the Hydrolab data and look forward to monitoring the health of our local watershed in the future.

Evaluation of the Science Club

We surveyed our students to help us evaluate our Science Club at the end of the first year. We took student comments—such as not covering enough of the physical sciences in club activities—seriously. For the club's second year, we included more chemistry and physics activities. For example, we invited a professor of water chemistry to give presentations to the group. The most successful science clubs are those driven by student ideas and desires. See our list of lessons learned during our first year of Science Club (Figure 9) and our tips for starting a science club at your school (Figure 10).

Conclusion

Creating activities and meaningful work for a high school science club is hard work. However, we have become better teachers as a result of our efforts. Our work with Science Club is some of the most meaningful work we engage in as teachers. We now think more about the greater purpose of teaching and how we can involve our students in meaningful and locally relevant science learning. An important tangential benefit is that Science Club allows more students to "fit in" at their high school and find enrichment in the process.

It is a joy to really engage our students in citizen science as

FIGURE 9

Lessons learned from the first year of the science club.

- Students are willing to spend their own time outside of the classroom having fun with science. Many are nature "novices" who crave these opportunities.
- Students will work hard for a good cause such as the International Coastal Cleanup and invasive species removal. Making a difference is empowering for students.
- We teachers are now more confident about taking classes outside instead of worrying that students will get distracted. We have found that students are so excited to get to learn outdoors that most really do work hard on the lesson.
- Spending time with other science teachers helping with the club was a great learning experience. We got to know each other on a more personal level and have fun together doing science.

FIGURE 10

Tips for creating a high school science club.

- Seek out local natural areas, parks, and camps as research or project venues.
- Require students to make presentations about club activities at local venues, including the board of education. Invite local news media if possible.
- Seek out professional development opportunities with potential for continued support. Ask local foundations for school funding. Be confident when asking for help.
- Service projects allow students to take ownership of the club. Seek out local projects that have an immediate outcome. Start with a small project like removing invasive species. Students will feel empowered upon completion of the task.
- Encourage students to report their data scientifically, giving their research a purpose and making them citizen scientists.
- Enlist another teacher in your school to help you, sharing responsibility and lightening the load of coordinating a science club.

they investigate environmental conditions in the community and also contribute to data gathered for the purpose of greater understanding of how humans are affecting the ecosystem. ■

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On the web

Field Trip Safety: *www.nsta.org/docs/FieldTripSafety.pdf*
Ocean Conservancy international coastal cleanup: *http://bit.ly/1dGACKx*
Hydrolab: *http://limnoloan.lakeguardian.org*
NOAA article on the Bay Watershed Education & Training (B-WET) program: *http://1.usa.gov/1MHLQ0k*
Pennsylvania Sea Grants: *http://bit.ly/1E4uwdR*

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