

9th Grade: Physical Science

1) Introduction: Service-learning is an excellent way to teach Science. Service-learning emphasizes a “hands-on” experiential approach as a means of connecting academic learning to real-world applications. This approach is an effective way of engaging students in scientific concepts, which can sometimes seem abstract. Service-learning brings students into direct contact with real-world community problem-solving and by framing the scientific method as a problem-solving tool itself, students can begin to see the impact science has on the world around us.

2) Definition of service-learning:

Service-learning is a form of teaching and learning that engages students in meaningful service activities in their schools and communities as part of the standard academic curriculum. Integrated into (but not limited to) the school day, service-learning connects young people with structured activities that address human and community issues, and that provide opportunities for increased student academic engagement, civic responsibility, personal and social development and the acquisition of critical thinking skills.

The following concepts are central to good service-learning practice. Evidence of these elements as well as their alignment with Pennsylvania state standards and the School District’s promotion/graduation requirements are key to model practices.

- **Student voice in choosing, developing and implementing a project:** Service-learning works best when students are involved in something relevant and meaningful to them. Encourage student participation and sharing of responsibility in all aspects of a project.
- **Identification of genuine need:** The “community” identifying the need can be the class, the school, the neighborhood, a community partner, the city, etc. Goals for addressing problem have the support of designated community and clearly defined goals.
- **Mutual benefit for students and community partner(s):** Students acquire knowledge and skills, and in return contribute a short or long-term solution to the problem. Sensitivity to needs and/or limitations of all parties is important.
- **Sustained student involvement:** Length of project can vary but should span a minimum of 8 weeks. Projects with greater richness and complexity may last a semester or an entire school year.
- **Rigorous, multidisciplinary research:** Projects should meet content standards in at least two academic disciplines and demonstrate writing and research competence. Research can explore root causes/effects, potential solutions or public policy related to the problem.
- **Ongoing reflection:** Reflection activities should occur throughout the project. They reveal cognitive and affective learning and can incorporate speaking, writing and/or multimedia strategies.
- **Assessment of student learning and project impact:** Evaluates academic, personal and social development as well as whether stated community need has been

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met/addressed. Rubrics and other authentic assessment tools are preferred.

- **Culminating presentation:** Presentations or exhibitions of learning allow students to demonstrate what they have learned for the benefit of others, including community partners.
- **Final celebration:** Positive change and collaboration is hard work! Acknowledge and celebrate the contributions and accomplishments of all who were involved.

3) Sample Project Description

A sample project description is included for your convenience. This particular project is not required, however, it is designed to fit the core curriculum for this subject and it reflects a common issue or problem in many of Philadelphia's communities. Teachers are encouraged to transform this project and take it in new directions.

Green School Project on Energy Efficiency: The Green Schools program is a school energy efficiency program that uses energy-saving action to teach science, math, English language arts, and social studies. It addresses several pressing issues: the need for resource efficiency in schools and home; the need for multi-disciplinary, hands-on learning opportunities for students; and the need for better communication and cooperation among stakeholders in a school (teachers, custodians, administration, students, and parents).

The Green Schools program improves education by allowing the school itself to become the tool for project-based service-learning. Students analyze the building's energy problems (3.1.10), research and develop possible solutions (3.2.10 C), work with others in the school to implement changes (3.2.10 D), and involve all the building users in the initiative. By its design, the Green Schools program allows students—and teachers—to practice critical thinking, problem solving, and decision making.

Students will design and implement various solutions depending on the specific problems of the school building (and larger community). Suggestions include: Energy Ambassadors (provide free informal energy audits for community residents), produce educational materials for the broader community (videos, brochures, etc), campaign for the adoption of energy-saving technologies in the school.

4) Suggested Lessons/Activities:

Situating Students in the Problem

- Why should students care about energy consumption? Energy production, consumption and the disposal of waste products are responsible for 80% of our pollution. Pollution creates health problems for communities (such as asthma and cancer), effects the environment (ex., smog and global warming), and costs billions of dollars each year to clean up. Have students explore the effects and costs of pollution and what that means for them as young people in order to “hook” them on this problem. (3.2.10)

Research

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- Exploration of energy usage (and waste) at home and in school. What powers our building? Where is energy wasted? Create a school building survey and a school energy map. Analyze data to find out where changes might be most effective.
- Research Paper topics: What do we mean when we say energy is “wasted?” What strategies have already been employed to help conserve energy?
- Debate public policy issues around energy consumption – should the government mandate a certain level of energy efficiency? What, if any, are the trade-offs between energy efficiency and the way we are used to living?

Creating a Solution

- This will be specific to your building’s problems and your students’ interests. Recognize there are three categories of solutions: technical (replacing light bulbs); retrofitting (weatherizing); and behavioral (turning off lights). You may want to divide the class into different teams which will focus on each of these strategies; but be aware that the category of behavior and operations offers the most options that can be directly controlled by students and other building users. Again, use the data that students collected to figure out what strategies you could initiate.

Assessment

- Involve students in determining if their intervention is successful. How many people/classrooms participated? How often? Students probably need to figure out ways to assess participation and from that estimate savings.

5) Sample Rubric

Rubrics can be used at all steps of the service-learning process. Each activity can have its own rubric, and you can use a cumulative rubric to assess student work at the end of the project. Here is a sample rubric that covers student presentations at the actual Health Fair. This rubric was created on Rubistar, a free web-based program which can be found at <http://rubistar.4teachers.org>.

See attached

6) Multidisciplinary Connections

Math – calculations of energy consumption patterns over time; costs savings of using certain solutions vs. not; comparative analysis of different cost savings plans

Technology – using Power Point to create presentations, using desktop publishing to create publicity materials such as posters and brochures esp. for behavior change solution; studying new technologies designed to reduce energy-consumption

Social Studies – link to 9th grade World History: study comparative energy use around the world, why do some countries use more energy than others? How has history influenced energy consumption?

7) Where to get more info?

Alliance to Save Energy: <http://www.ase.org/>

Environmental Protection Agency: <http://www.epa.gov/>

National Council for an Energy-Efficient Economy: <http://www.aceee.org/>

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8) Local Partners:

Philadelphia Green Schools Program: <http://www.ase.org/greenschools/>

Delaware Valley Green Building Council: <http://www.dvgbc.org/>

Energy Coordinating Agency: www.ecasavesenergy.org

Penn Futures: www.cleanyourair.org

Student Environmental Action Coalition: <http://www.seac.org/>

SDP Green Futures Initiative: <https://www.philasd.org/greenfutures/>

This curriculum insert was developed by Janet Castellini, Director of the Greater Philadelphia Green Schools Project, as part of a collaborative effort between the School District of Philadelphia and several local community-based service-learning organizations, designed to integrate service-learning with the new core curriculum.

Revised by Ben Sereda, Administrative Coordinator PHENND, 8/19/2020