School-Wide Recycling

Model K-12 Service-Learning Lessons

Source: RMC Research Corporation, June 2009

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Overview

Students will learn about what materials are recyclable, how they are recycled and how this benefits the environment by visiting a local recycling center. Students will then work together collecting scientific data in order to design a recycling program for their school and then present their findings and ideas to the school principal. Through the collection and presentation of data, students will sharpen their mathematics, science and English skills. At the end of the semester, students will demonstrate their knowledge through presentations to the community, family members, school staff and other classes.

Contents

Lesson Plan Information

Title: School-Wide Recycling Program
Grade level(s): 3
Subject area(s): Mathematics, Science, English Language Arts

Standards addressed:
Mathematics (based on the National Council of Teachers of Mathematics Standards)
Data Analysis and Probability

- Students collect data using observations, surveys, and experiments.
- Students represent data using tables and graphs such as line plots, bar graphs, and line graphs.
- Students recognize the differences in representing categorical and numerical data.
- Students predict the possibility of outcomes of simple experiments and test the predictions.
- Students communicate the results of basic data analysis.

Measurement

- Students understand attributes such as area, weight, and volume and select the appropriate type of unit for measuring each attribute.
- Students understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.

Science (based on the National Science Education Standards)
Science as Inquiry

- Students understand the concepts of basic scientific inquiry.
- Students develop the abilities necessary to do basic scientific inquiry.
- Students select and use appropriate tools to make measurements (including metric units) and represent results of basic scientific investigations.
- Students communicate the results of basic scientific investigations.

Physical Science

- Students examine, measure, describe, compare, and classify objects in terms of physical properties.

Science in Personal and Social Perspectives

- Students simulate scientific collaboration by sharing and communicating ideas to identify and describe problems.
- Students use scientific knowledge to make inferences and propose solutions for simple environmental problems.

English Language Arts (based on the National Council of Teachers of English Standards and the California Department of Education Grade 3 English Language Arts Content Standards)

Writing

- Students write clear and coherent sentences and paragraphs that develop a central idea. Their writing shows they consider the audience and purpose. Students progress through the stages of the writing process (e.g., prewriting, drafting, revising, editing successive versions).
- Students write compositions that describe and explain familiar objects, events, and experiences.

Oral Language

- Students deliver brief oral presentations about familiar experiences or interest that are organized in a coherent manner. Student speaking demonstrates a command of standard American English and organizational and delivery strategies.

Communication

- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

Objectives:

- Students will learn about recycling and reuse of recyclable materials.
- Students will apply grade-appropriate mathematics, science, and English language arts concepts in their service-learning activities.
- Students will learn how to partner and work with community organizations.
- Students will learn how to work in teams and develop their leadership skills.
- Students will provide a meaningful service to their school and/or community.

Time needed for completion: Activities in the classroom and out in the community will be conducted during a daily mathematics class period over a span of one semester (approximately 50 hours across 16 weeks)

Materials needed: Video camera, digital cameras, poster board, markers, graph paper
Keywords: Recycling, environment, mathematics, science

Service-Learning Components

Investigation

Week 1: Introduction to Recycling and Service-Learning
The lesson begins with the teacher presenting the curriculum objectives for the semester, the goals of service-learning, and what students will be doing in the coming weeks. The teacher begins to discuss basic mathematics and science concepts that students will be learning. Then the teacher talks about the concepts of protecting the environment and the importance of recycling. During the week, a representative from a local waste management facility visits the classroom and talks to the students about waste, the importance of recycling, and the types of recyclables found in various parts of the community. The teacher asks the student whether they think the school has a recycling program (which is does not). The students discover that the school does not have a recycling program and then discuss whether or not it should. A vote is taken and the majority of the class indicates that they would like to start a school-wide recycling program.

For a *reflection activity*, the teacher asks students to write in their journals about something new they learned about recycling, some of the pros and cons about recycling, and to interview family members about what they recycle at home and/or work. The teacher also begins to document the service-learning project by taking photographs of students engaged in activities, listening to the speaker, etc.

Week 2: Measuring What We Use – Personal Investigation
During this week, students participate in activities in which they investigate data in connection with recyclable materials. This allows them to personally experience and measure what they use in a given week. A sample of activities involving classroom paper, aluminum cans, grocery bags, and plastic packaging can be found online at the National Council of Teachers of Mathematics Web site at http://www.illuminations.nctm.org/LessonDetail.aspx?id=U84. Students form teams and select which activity they would like to participate in. With guidance from the teacher, they develop norms for team behavior, discussion of differing ideas, and ideas for resolving conflict that may arise.

Each activity includes gathering, graphing, and interpreting data, thus extending opportunities for communicating, reasoning, and problem solving. Each activity also features ideas to share with classmates or family members. For example, in the *Classroom Paper* activity, students:

- Discuss the ways they use paper in the classroom;
- Predict the number of pieces of paper they will use each day during the week;
- Tally the actual number of pieces of paper they use;
- Graph the results;
- Discuss/reflect on ways of saving paper; and
- Make a poster based on their suggestions for saving paper and present it to the class.

Teacher assessment of student work can take place in the form of progress monitoring against mathematics, science, and language arts standards; using rubrics for student presentations; and evaluating how well students are writing in their journals.

Weeks 3-4: Needs Assessment for a School-Wide Recycling Program
The students invite the school's principal to their classroom so they can present their ideas for a school-wide recycling program to him/her. The principal grants students permission for the project. Students then investigate when, how, and the types of materials that will be collected at the school. The teacher guides students in generating questions for a survey to give to classroom teachers, administrators, custodial workers, cafeteria workers, and other support staff. The survey can include questions about staff attitudes toward recycling, what types of materials staff generally throw away, what types of recycling containers would be useful to staff to have in their classrooms/offices, and when materials can be collected by the custodial staff.

Students collect the surveys, tabulate the responses, and analyze data from the survey responses to determine next steps for launching the school-wide recycling program. Mathematical concepts such as how to determine simple descriptive statistics including frequencies, means, mode, and ranges can be introduced by the teacher and included in assessments. More information on working with students to formulate questions that can be addressed with categorical and numerical data and how to represent and analyze data can be found at http://www.illuminations.nctm.org/LessonDetail.aspx?id=U116.

The teacher and students work together to develop a timeline for the school-wide recycling program and outline the activities to be completed so they can assess their progress against their goals.

Preparation

Week 5: Who Can Help Us?
At the beginning of the week, the teacher and students review their ideas for the school-wide recycling program. The teacher poses reflective questions for students to discuss in small groups, such as:

- *Are there any other ideas that we need to consider?*
- *Who can help us with our school-wide recycling campaign? (e.g., the representative from the waste management company, school district maintenance staff, parent volunteers)*
- *What information and materials do we need from them? (e.g., recycling bins, collection dates, help with sorting materials)*

Students develop contact lists for the partners whom they then write to and invite to visit their class. The teacher proofreads and edits the letters and has students make corrections to them before they are mailed.

Weeks 6-7: Preparing for the School-Wide Recycling Program

The teacher provides students with guidelines and samples of informational materials (flyers, announcements to be read over the school intercom, posters, etc.) that will be distributed to school staff and students about recycling. The teacher asks students to discuss what kinds of information staff need to have (e.g., why its important to recycle, what can be recycled, and when the recycled materials will be collected).

Students then work in teams to prepare posters and informational materials that will be distributed to school staff about recycling. They also work together to develop a skit on recycling that they present at a school-wide assembly at the end of the week. The skit is videotaped by a parent volunteer. If the school is a dual-language school, the materials and the skit can be produced in English and the school's second language. The teacher works with students to contact local media about the recycling program.

During this time, the teacher engages students in activities about recycling that are tied to mathematics, science, and language arts content standards. These can include:

- Learning vocabulary words related to recycling and writing short-response essays;
- Solving mathematics problems in which the answers help decode messages about recycling;
- Matching pictures of raw materials with the products that are manufacturing from them (e.g., trees into notebook paper, oil into plastic bottles); and
- Predicting how long items such as banana peels and Styrofoam cups will last before they decompose.

Ideas for activities can be found at:

www.dec.ny.gov/docs/materials_minerals_pdf/studentbook.pdf

www.tulane.edu/~eaffairs/PDFs/williamslessons.pdf

Students and the teacher check on how they are doing against the timeline they developed. For a *reflection activity*, the teacher begins a digital photo file of the project on the computer and prints off some of the pictures for students to write about in their journals to document the progress they have made.

Action

Weeks 8-10: The School-Wide Recycling Program is Launched

The representative from the waste management company brings recycling containers to the school for use during the coming weeks. Students and the school's custodial staff distribute recycling containers throughout the school along with information about recycling that the students wrote. Students make announcements about the campaign over the intercom. During the three weeks, school staff and students put recyclable materials into the containers that were provided.

In class, students make predictions about the amount and types of materials that will be collected, how much the different types of materials will weigh, and how much space the

materials would take up in a landfill if they were not recycled. Mathematical concepts such as volume; area; conventional versus metric measurements; and generating fractions, decimals, and percents from measurements can be introduced during this time. Science concepts pertaining to investigation can also be employed. Teacher assessment of students' knowledge of these mathematics and science concepts also takes place.

At the end of the three weeks, the teacher asks students to answer the following questions in their journals as part of their *reflection:*

- *What have you learned about recycling that you did not know at the beginning of the semester?*
- *What ideas do you have for how we can share what we have done with the community around us?*
- *How did you feel when you talked to other students and teachers about recycling and why?*
- *What did you get excited about when we went to different classes last week and why?*

Students can also draw pictures to accompany their responses. The teacher makes a chart with the column headings **L** (learning), **I** (ideas), **F** (feelings), and **E** (excited). The students write in their responses on the chart and then categorize and graph them to see how many were generated under each heading.

Weeks 11-12: Collecting the Recyclable Materials
Students and the school's custodial staff collect the containers with the recyclable materials. Parent volunteers sort the materials by type, based on instructions and safety tips provided by the waste management facility. Students photograph and videotape this process. The representative from the waste management facility brings a scale to the school so students can weigh the materials, record the information to compare to the predictions they made, and graph their findings.

The representative talks about what would happen if the materials took up space in a landfill and asks students to predict how much volume the different types of materials that were sorted would take up if they were not recycled. The teacher asks students to compute the total volume and compare it to the figure provided by the waste management representative so they can inform school staff about how much trash was saved from the landfill. The teacher lets students know that they will visit the recycling center next week so they can see first hand what happens to the recycled materials that were collected at the school. The waste management company picks up the recycled materials that were collected.

The teacher asks students to work in teams to generate ideas for how to thank school staff for their participation as part of a celebratory event that will take place at the end of the semester. Students discuss and *reflect* in their journals about how the recycling campaign went, how they felt once they saw how much material was collected, and suggestions they have for improvement of the project. Several students decide it would

be a good idea to design and create a large chart to put in the front hallway to inform school staff, other students, and parents about their progress. They present this idea to their classmates and teacher. The other students vote on the idea and agree that it is a good one. The school principal gives approval for the chart to be displayed and the students who came up with the idea and several of their classmates make the chart.

Weeks 13-14: Recycling in Our Community
The teacher reviews with students what happens when materials are recycled and asks students to begin thinking about how recycled materials can be reused. The students and teacher visit the local waste management facility to see what happens to the recycled materials they collected. Students photograph and videotape this process. When students are back in the classroom, the teacher asks them to *reflect* in their journal about their field trip i.e., discuss what they learned and what happened to the materials they collected. The teacher reads the journal entries and assesses them based on students' writing abilities.

The teacher asks students to divide into teams and participate in exercises involving how many ideas they can generate for reuse of a particular item like a plastic laundry detergent container or glass jar. The teacher lets the students know that they will continue their service-learning next semester by making items from recycled materials and coming up with ideas about how the items could be used to benefit people in the community. For example, students could make toys and games from recyclable materials and present them to children at a local hospital. More ideas can be found at www.makingfriends.com/recycle.htm.

Reflection

Reflection activities are woven throughout the entire semester of activities. They include journal writing, classroom discussions and exercises, a skit presented at a school assembly, discussions with community partners and family members. More ideas for reflection activities can be found in *Connecting Thinking and Action: Ideas for Service-Learning Reflection*, available from RMC Research Corporation, Denver, CO at www.rmcdenver.com/adx/aspx/adxGetMedia.aspx?DocID=103

Demonstration/ Celebration

There are a variety of ways students can demonstrate what they have learned. Throughout the semester, they can make posters about recycling using the graphs they worked on and hang them outside the classroom. This allows students to demonstrate their knowledge about recycling and the mathematical and scientific concepts they are learning. Presentations to other classes and school staff provide students an opportunity to share their knowledge and use higher-order thinking skills such as application, inference, and summarization. Rubrics can be used by the teacher to assess student knowledge in relation to content area standards and objectives. Demonstration of learning can also occur in conjunction with a culminating, celebratory event at the end of the semester.

At the end of the semester, students invite their community and school partners, family members, the media, and school board members to a reception. They display posters of their project demonstrating what they learned, share some of their reflections, and show photographs and a videotape of their work. They present community and school partners with thank you letters. In turn, the community partners and school board members present students with certificates of recognition. Plans are now in place at the school for more classes to be involved in service-learning and for an ongoing school-wide recycling program.

Service-Learning Standards

Duration and Intensity
Service-learning has sufficient duration and intensity to address community needs and meet specified outcomes.

Indicators:

1. Service-learning experiences include the processes of investigation of community needs, preparation for service, action, reflection, demonstration of learning and impacts, and celebration.
2. Service-learning is conducted during concentrated blocks of time across a period of several weeks or months.
3. Service-learning provides enough time to address identified community needs and achieve learning outcomes.

   The lesson takes place over the course of a semester (approximately 50 hours) and addresses the processes of investigation of community needs, preparation for service, action, reflection, demonstration of learning and impacts, and celebration.

Link to Curriculum
Service-learning is intentionally used as an instructional strategy to meet learning goals and/or content standards.

Indicators:

1. Service-learning has clearly articulated learning goals.
2. Service-learning is explicitly aligned with the academic and/or programmatic curriculum.
3. Service-learning helps participants learn how to transfer knowledge and skills from one setting to another.
4. Service-learning that takes place in schools is formally recognized in School Board policies and in student records.

   The learning goals in this lesson plan are articulated in the objectives. The project incorporates National Council of Teachers of Mathematics Standards, National Science Education Standards, National Council of Teachers of English

Standards, and the California Department of Education English Language Arts Content Standards for Grade 3 and is aligned with the school district's mathematics, science, and English language arts curriculum. Students transfer knowledge and skills from the classroom to the school at-large and community and vice versa. A district-wide service-learning policy is being developed that will include recognition of service-learning credits in student records.

Partnerships
Service-learning partnerships are collaborative, mutually beneficial, and address community needs.

Indicators:

1. Service-learning involves a variety of partners, including youth, educators, families, community members, community-based organizations, and/or businesses.
2. Service-learning partnerships are characterized by frequent and regular communication to keep all partners well-informed about activities and progress.
3. Service-learning partners collaborate to establish a shared vision and set common goals to address community needs.
4. Service-learning partners collaboratively develop and implement action plans to meet specified goals.
5. Service-learning partners share knowledge and understanding of school and community assets and needs and view each other as valued resources.

   Partners for this lesson include the local waste management company; school administrators, staff and students; and family members. Students and the teacher provide written and online progress updates to partners every other week. Students work with partners to develop project plans for the school-wide recycling campaign.

Meaningful Service
Service-learning actively engages participants in meaningful and personally relevant service activities.

Indicators:

1. Service-learning experiences are appropriate to participant ages and developmental abilities.
2. Service-learning addresses issues that are personally relevant to the participants.
3. Service-learning provides participants with interesting and engaging service activities.
4. Service-learning encourages participants to understand their service experiences in the context of the underlying societal issues being addressed.
5. Service-learning leads to attainable and visible outcomes that are valued by those being served.

This lesson was piloted last year and was found to be appropriate to participant ages and developmental abilities. Students and school staff demonstrated high interest and in a school-wide recycling campaign and the effects the project would have on the school and community at large. Throughout the semester, students, school staff, and family members learn about how recycling impacts their community and the environment and the role they can play in making the school and their homes more environmentally friendly.

Youth Voice

Service-learning provides youth with a strong voice in planning, implementing, and evaluating service-learning experiences with guidance from adults.

Indicators:

1. Service-learning engages youth in generating ideas during the planning, implementation, and evaluation processes.
2. Service-learning involves youth in the decision-making process throughout the service-learning experiences.
3. Service-learning involves youth and adults in creating an environment that supports trust and open expression of ideas.
4. Service-learning promotes acquisition of knowledge and skills to enhance youth leadership and decision-making.
5. Service-learning involves youth in evaluating the quality and effectiveness of the service-learning experience.

Students are involved in planning, implementing and evaluating the school-wide recycling campaign and the effectiveness of their experience. They are engaged in an open dialogue with the teacher throughout the process, especially during reflective activities. They develop leadership and decision making skills through their work in teams and when communicating the goals of their project to administrators, other students, and school staff.

Diversity

Service-learning promotes understanding of diversity and mutual respect among all participants.

Indicators

1. Service-learning helps participants identify and analyze different points of view to gain understanding of multiple perspectives.
2. Service-learning helps participants develop interpersonal skills in conflict resolution and group decision-making.
3. Service-learning helps participants actively seek to understand and value the diverse backgrounds and perspectives of those offering and receiving service.
4. Service-learning encourages participants to recognize and overcome stereotypes.

Students learn about the pros and cons of recycling from partners and through surveys of school staff about their opinions of recycling. Students work in teams throughout the project during which they develop skills in conflict resolution and group decision-making. Our school is a dual language English-Spanish school so the skit was presented in English and Spanish and materials were written in both languages.

Reflection

Service-learning incorporates multiple challenging reflection activities that are ongoing and that prompt deep thinking and analysis about oneself and one's relationship to society.

Indicators:

1. Service-learning reflection includes a variety of verbal, written, artistic, and nonverbal activities to demonstrate understanding and changes in participants' knowledge, skills, and/or attitudes.
2. Service-learning reflection occurs before, during, and after the service experience.
3. Service-learning reflection prompts participants to think deeply about complex community problems and alternative solutions.
4. Service-learning reflection encourages participants to examine their preconceptions and assumptions in order to explore and understand their roles and responsibilities as citizens.
5. Service-learning reflection encourages participants to examine a variety of social and civic issues related to their service-learning experience to understand connections to public policy and civic life.

   Reflection activities are woven throughout the entire semester of activities. They include journal writing, classroom discussions and exercises, a skit presented at a school assembly, discussions with community partners and family members. Reflection activities are also incorporated into teacher assessment of students' knowledge of community problems, solutions, and their roles as citizens.

Progress Monitoring

Service-learning engages participants in an ongoing process to assess the quality of implementation and progress toward meeting specified goals, and uses results for improvement and sustainability.

Indicators:

1. Service-learning participants collect evidence of progress toward meeting specific service goals and learning outcomes from multiple sources throughout the service-learning experience.
2. Service-learning participants collect evidence of the quality of service-learning implementation from multiple sources throughout the service-learning experience.

3. Service-learning participants use evidence to improve service-learning experiences.
4. Service-learning participants communicate evidence of progress toward goals and outcomes with the broader community, including policymakers and education leaders, to deepen service-learning understanding and ensure that high quality practices are sustained.

   Evidence of progress is collected from student reflection activities, the timeline/task chart that students develop. During the semester, the teacher checks in with students, school staff, and partners to see if any aspects of the project need to be improved. Student and teacher assessment of the project at the end of the semester helps develop ideas and suggestions for next semester's project and future service-learning activities at the school.

Sources if not original:

National Council of Teachers of Mathematics
Mathematics and Environmental Concerns lesson plan
illuminations.nctm.org/LessonDetail.aspx?id=U84

United States Environmental Protection Agency. *Service-Learning: Education Beyond the Classroom*. Washington, DC: Author, 2002.
www.servicelearning.org/library/lib_cat/?library_id=4642