



School survey on live plants and animals in the classroom

Grade

5th–8th grade

Length

13–14 Class Periods

Subjects/strands

Social science, scientific inquiry, statistics and probability, social studies

Topics

Developing good questions, scientific method, public opinion data, cooperative and collaborative work

INTRODUCTION

This lesson provides teachers with detailed guidelines on how to lead a classroom to conduct a school wide survey on the live plants and animals present in each classroom, the level of awareness of potential invasiveness of these plants and animals, plans for care for the organisms over the summer break, and feasible solutions to prevent invasive species spread.

Students will engage in real social science research by developing survey questions based on a hypothesis, collecting survey responses from other classrooms, entering and displaying the data, then analyzing and presenting their results. Through this lesson, students will be raising awareness and encouraging appropriate action on what to do with unwanted classroom plants and animals.

Many students have had experiences with preference surveys in mathematics by the time they reach middle-school age. The majority of this statistical math work involves individual students or groups collecting data within their classroom, with children asking simple questions regarding food or brand preferences. Their tallies of subjects such as “Ice Cream Flavors” or “Sneaker Choices” emphasize learning to quantify discrete data in bar-graph form.

The next step is to broaden their skill base in data collection, using topics that allow students to collect useful information for possible further study by them and others. Students need to:

- Develop relevant questions that are answerable.
- Develop answers to questions that are inclusive (all possible choices).
- Develop skills in methods for data collection.
- Recognize factors that introduce bias in data.
- Learn to present the most useful information from their data.
- Develop collaborative and cooperative work habits

that will facilitate success.

This process is important for all students in science as well as other related subject areas.

The focus of this student-conducted survey project is collecting information on the understanding of invasive species, as well as their presence or potential presence and care in the classroom. In order to carry out such a survey, the teacher must pre-assess several things, and answer some questions. These include:

1 Will the principal or other direct supervisors support these efforts?

Let them know ahead of time what you have planned, with ready answers to their concerns.

2 Have other surveys recently been conducted in the school?

Reception of your students will be much more positive if no other data collection has happened in the recent past.

3 What is the attitude of the individual staff members toward having students briefly interrupt their teaching?

Students will be making appointments for data collection with teachers who welcome their efforts.

4 What is the best method for communicating upcoming data collection efforts by your students to other faculty, and their feedback on student behavior?

Teachers love to be warned about anything that might interrupt their curriculum. They also appreciate having a concrete way to give positive and negative feedback on student behavior and efforts during visits to their classroom.

5 Which students cannot be sent to another classroom without direct supervision?

Every class has leaders, followers, and some students who see this type of project as a chance to act out. As in all school activities, teachers have to make choices in

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grouping. However, this particular activity requires groups of students who are out of her/his sight for brief periods of time, and some students may not be mature enough to handle this. Those students must either be directly accompanied by an adult or be required to stay back in the classroom and handle data tallies or other tasks.

This type of project requires preparation of students on conducting themselves in a professional manner, and middle-school students often welcome the opportunity to show their maturity while taking on opinion survey tasks. What makes this particularly appealing to students is their ability to take a real-world problem that affects both humans and other living beings and apply it to their own learning. They will have an even higher motivation to collect useful data if they know that their data will be used by professional scientists to inform on aspects of the issue within certain segments of the public.

The survey project requires students to question the understanding and choices of both students and adults. Children are often unaware of the effect their choice of action has on others; therefore, the positive crafting of the questions, answers, and methodology is the key to success, both in terms of cooperation by participants and useful data collection.

The topic of invasive species is becoming more widespread in mainstream science curricula, but many teachers are unaware of the scope of this problem. Well-meaning teachers who provide science lessons often have little knowledge of the topic, and they may include live classroom animals that have been obtained without an understanding of the choices available to education professionals. Students should come into this project with basic information about (1) general invasive species issues, (2) local invasive species problems, and (3) the availability and use of classroom plants and animals (including disposal).

LEARNING OBJECTIVES

Students will be able to develop good question-and-answer choices for a self-conducted opinion survey, recognize bias and outliers in data, collect scientific data, process and graphically represent data, and analyze and present data. Students will draw inferences about a population based on samples, and draw informal, com-

parative inferences about two populations. They will become knowledgeable about the extent of awareness of invasive species among peers and school-based adults, as well as their current and projected treatment of these species. They will be able to make sense of problems and persevere in solving them.

BACKGROUND

Information on native and invasive species ecology, both general and local, lessons on methods of collecting data, and practice representing data in various graphic forms and displays. Older students should be able to calculate percentages. Students should be able to work in cooperative groups, identifying and assigning roles in a multi-step task.

MATERIALS NEEDED

- Overhead projector/computer/document camera
- Roster of teachers and classroom #'s
- Teacher/student appointment chart (to be made during project)
- Several reams of copy paper
- Clipboards
- Notebook paper
- Colored markers
- Computers
- Printers
- Copy machines

VOCABULARY

Adaptation, analysis, bias, conclusion, competition, data, frequency, food web, generalist species, hypothesis, invasive species, native species, operational definition, outlier, overpopulation, predator, question, reproduction, response, specialist, survival strategy, tally, and variable

PREPARATION

Basic understanding of species adaptations, competition, food webs and resource limits, understanding of how to transfer data from a table to graphic representation, practice working cooperatively as a group to accomplish a task (single and multi-step), familiarity with terms from the Scientific Method, and practice/

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knowledge of acceptable methods for utilizing others' time outside the classroom. Students should come into this lesson being relatively familiar with some of the specific problems that invasive species cause world-wide and locally, and possibly for classroom teachers in particular. For the teacher: See "pre-assess" questions in the INTRODUCTION.

PROCEDURE

(A) Organize

[This section will take up to five days]

- 1 Post the following questions on the overhead:
 - "What do you think other people should know about invasive species?"
 - "What do students and teachers in our school know about invasive species?"
 - "What simple things do we want to ask them about invasive species?"Tell students that these questions are the beginnings of a survey project, and all three are really about the same thing; namely, how scientists can affect public opinion and action by asking and finding answers to questions. Explain that they could make a separate list for each, but they don't have to. Ask student table groups to appoint a recorder to take notes and discuss as a group, and a representative to report back to the whole class. Give established table groups at least three to five minutes to talk about these questions, and record group comments. (Younger or ELL/ELD students: Ask for one answer for each question.)
- 2 While each representative is speaking, post comments on the overhead screen. Some of the responses you get will be simple, like "What is an invasive species" and "Do you have an invasive species pet in your classroom," while others will be more in depth ("If you had a choice, what would you pick for a classroom pet," or "How would you dispose of an animal if you knew it was invasive"). If any of the responses are not related, too long, or don't make sense, try to reinterpret to fit the project. Complement any repeats as high interest.
- 3 If your students are 5th or 6th graders, tell them that the overriding question they are trying to answer is:
 - "What do people at [name of your school]

know and feel about invasive species?"

If the students are 7th or 8th graders, have them offer suggestions to be posted on the overhead. Explain that groups are going to ask three questions about invasive species in other classrooms or of teachers throughout the building, and those questions need to be "answerable" in a scientific survey that can be quantified and graphed. Discuss the characteristics of an "answerable survey question" and what it might look like. Choices should include:

- a Something that is directly related to what your students want to find out.
- b Something that makes sense (in writing form and content).
- c Something that might be of interest to the survey taker.
- d Something that does not take too long to answer.
- e Something that is not highly embarrassing or threatening to the survey taker.
- f Something that can be counted easily (quantified).

Ask students whether they have ever taken a survey themselves, and discuss with the whole class why people might choose not to answer a question. Talk about questions that are confusing, uninteresting, embarrassing, or take too long to read or answer. Make sure you also explain that while *surveys are supposed to be anonymous* (no names!), people will not answer a question honestly if questions are too personal and they think the people around them might know what they are thinking.

- 4 Discuss the settings for survey-taking, and how that might influence the honesty of the answers. Since a classroom setting is not the best one for getting unbiased answers, the structure of the survey becomes even more important. Introduce the idea of BIAS, and have a discussion about the importance of crafting the questions to reduce the amount of bias in the data. In particular:
 - a Relate back to (3) where questions can be easily and quickly answered.
 - b Talk about how data is gathered (either individual copies, show of hands, or private and/or group interviews). *The best choice for all reasons*

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(except conservation of resources) is the individual survey copy for each student/teacher. If there is an issue with paper in your school, then either bring several reams of your own or request them from the Administration or your students ahead of time.

- c** Discuss the idea that they (the surveyors) must be observing the behavior of the survey takers, and notice whether anyone is not taking it seriously. *If so, they should make a small mark (decided on by group) on the paper as they collect it, so they can tally these separately [more on this later].*
- d** Point out that the ENTIRE METHOD of giving the survey will affect the data. *This includes not only the survey itself, but the manner in which the students come into the room and introduce their project and the survey, as well as how they collect them at the end.*

Discuss how students would respond to questions differently if:

- a** They introduced themselves and their project to the class, or not,
- b** They asked students to respond to questions with a show-of-hands/tally vs. a individual survey per student, and
- c** They acted like they cared about the results, or not!

Students will need to think about these things later as having possibly influenced the responses by students in their surveys.

- 5** Have a detailed discussion about ANSWER CHOICES. In order to be quantified and graphable, survey answers must be inclusive, easy to interpret (by both the survey-takers and the students tallying the results), and understandable. Typical responses to many questions will be:
 - a** Yes
 - b** No
 - c** Not sure
 - d** Other _____

Talk about why it is important to include “Other” as a possible answer. This has to do with the idea that if you want an accurate representation of opinions and experiences, you must include all possible answers in response to a question. . There is no way

you could possibly think of or have space to include every human response; there are too many variations in the minds of human beings.

If you include a _____ after the “Other” response, it might give students additional insight into their respondents’ thoughts. However, what students usually find is that this gives them information that is either confusing, nonsense, or otherwise non-quantifiable. It also gives them a chance to see how difficult interpreting human responses can be, which is useful in the analysis and conclusion of their “experiment” (the survey). It’s all part of the learning experience!

- 6** At this point, it would be very useful to have students gather their own “background research” in order to create their HYPOTHESIS about the responses of the school population. They do this by *surveying their own class*, asking only one of the questions they are going to use. The following needs to be done before surveying:
 - a** Group students into threes or fours, depending on the structure and numbers. This arrangement of students will later become the surveying groups.
 - b** Post the possible questions you have defined/ redefined from the class discussions, and have each group pick one simple question (yes/no/ not sure/other) they would like to ask everyone in the class, including themselves. This question will be the basis for the other two to four questions they design for their larger survey; younger students can simply use this one question.
 - c** Give out a clipboard, ruler, and notebook (lined) paper to each group, and have them write out the question and answers they choose on the paper. Make sure they know to leave enough room to make a tally for all the responses chosen by their classmates. They can make a table if they like, which helps them organize for their own survey efforts.
 - d** Give students about 15 minutes (depending on age) to gather survey information and count the tallies. They should share the question, answers, and tally results within the group, to be written in their Science Notebooks. If students already

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know how to calculate percentages, they can include this in their results.

- e Discuss the results. Make sure they verbally state the differences between the numbers to you out loud (for example, “10 students said they would release an invasive pet in the wild at the end of the school year, and 15 said they would not release”). Point out that this data is part of their background research, since they themselves are part of a “subset” of the entire school’s population. Also, they now have a basis for predicting how the larger population of students in the building will respond to their question, and extrapolate to other question responses.
 - f Students should now spend at least 15 to 30 minutes writing questions related to the one they originally chose. Three questions are ideal, and it’s possible that up to five is appropriate for any particular survey. Help students come up with the best choices for answers if they have trouble with this, or choose more-advanced students to make suggestions for struggling groups when possible.
 - g Explain to students that they can simply compare the results of answers for one question (best for predictions by younger students) or more questions, or the differences between groupings of people for the same question. Typical choices for the latter are male vs. female and different age responses. The higher the differentiation of data, the more calculations and variety of graphic representation. Eighth graders might want to look at three different age responses for one questions, and break ages into male/female sub-groups as well. Students also may want to survey teachers and compare their answers to student answers, or differentiate between teachers of older vs. younger students.
Note: If students choose to break responses into groups for comparison, they must have a place on their survey to indicate this (most often at the top of each sheet). Problems with this include respondents deliberately writing false information and refusing or forgetting to choose. Students in the group can check each paper as they collect, if possible.
 - h Have groups decide HOW MANY CLASSES (figure approximately 25 students per class for a round number) they want to survey; groups should survey between two and five classes, depending on the age and group dynamic. Statistically, more is better but very time consuming in the implementation and tallying, not to mention paper consumption.
- 7 Have students write a HYPOTHESIS in their notebooks regarding what they think will be the response to their original question in the larger population of the school. Make sure they include numbers (count or percentages) in their written hypothesis. They can choose the same hypothesis as other group members if they agree, or write a different one if they disagree. They can also choose a different, related question to hypothesize about.
 - 8 The next whole-class discussion is about the ORDER of the questions. There is a natural order or flow in terms of respondent understanding, and examples should be given. Questions about the basic understanding the survey-takers have regarding invasive species should come first, how they feel about them should come next, and what they would do about them should follow. Some questions will require multiple answers beyond yes/no/maybe/other. These include those that give respondents lots of choices for opinion or action. There is a lot of variation in organization here, but it is generally better to have more-complicated questions follow simple ones. *Teacher approval is necessary for wording, structure, content, and occasional censoring needs. Not only does this facilitate success of student effort outside your classroom, but it also keeps objections by other staff members to a minimum.*
 - 9 The last organizing class discussion should be about the INTRODUCTION PARAGRAPH each group should write and place at the head of its survey. This is a short description of what students want the survey-taker to know about the subject and their reasons for the survey in the first place. The purpose of this Introduction Paragraph is to reduce the variation in respondent understanding of the subject, thereby reducing bias and error in the data. The content should be tailored to the questions chosen by the students, and appropriate for the age group whose classes they are visiting. *It should be written, edited, and shown to you for approval.*

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al before adding it to the survey. They can either read it to the whole class before taking a show-of-hands tally, or have it printed at the top of each survey before the questions.

- 10** Have ready a *Table or Roster of Teachers, Classroom Numbers, and the Grades of Their Students*. Spend part of a class period assigning student groups to different teachers in any way that seems appropriate; older groups can make requests, or you can choose for younger students. You should provide or ask older student groups to create a *table or form with Teacher Names, Appointment Date and Time Choices, and a place for comments*. Teachers appreciate organization, especially when it means fewer interruptions for them.

Students should be ready before the appointment request with the best choices for dates/days, periods, etc. Make sure that the first choice of appointment times is ALWAYS during your own class period (on any day/date). If this is not possible, prearrange with teachers who are willing to let students leave their classroom for up to 15 minutes to administer a survey; this is not a good idea unless the student group is running out of time due to teacher absence, assemblies, or other unforeseen issues.

- 11** *Practice* (first with a demonstration) with students the correct way to enter and leave a classroom with single or paired representatives to request appointments for surveys. It's best to have students practice knocking on the door, entering with their clipboard and form for appointment choices, and a SCRIPT that students have made up ahead of time.

The script should include who they are, what class and assignment they are involved in, and what they want from the teacher and her or his students. Make sure that students include a sentence or two about invasive species, that the survey is anonymous, how much time it should take (10 minutes maximum), and what they hope to accomplish with the data.

- 12** Spend a part or all of one or two class periods sending student groups out to other classrooms to make appointments for surveys. Some groups will return happy, with all their requests received well and appointments made. Some will not, and you should make notes regarding these for a follow-up, either with the teacher involved or with the student groups, or both.

If another adult is available, particularly for younger students or those who have behavior issues, have them accompany students to the door of the classroom and wait there, while students handle their business with the appointments. Students who cannot handle this level of maturity in academic work will become quickly apparent, and they can be alternately assigned to related work in their own classroom while the other group members have a chance to gain this valuable experience. Students should have at least two classrooms they can survey for the project.

(B) Implementation

[Three class periods to collect survey data]

- 1 Student groups will collect their data over a two- to three-day period, given the many variations and requirements of other teachers' schedules and classes. It is not necessary to have all the students from each group collect data at one time, but it is a good idea to make sure that all students (except for those with behavior and maturity issues) have an opportunity to do this.
- 2 Students can take turns with the different jobs required while collecting and processing data:
 - a Carrying surveys/clipboards/pencils
 - b Announcing/reading "survey introduction" to class
 - c Handing out surveys
 - d Collecting surveys
 - e Tallying (if done as a whole class)
 - f Counting raised hands (if done as a whole class)
 - g Saying "Thank you" to entire class at the end of the process
- 3 Spend at least 10 minutes at the end of each class period during this phase to bring students back together for putting away survey materials, making comments, and discussing any problems that may have arisen. Troubleshoot by encouraging students with problems within their group to come to you individually with issues.

(C) Processing and Organizing Data

[Four class periods to tally data and graph results]

- 1 Tasks to be handled back in their classroom are:
 - a Organizing surveys back in their own classroom

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- b** Creating/drawing the Data Table for processing information
- c** Reading out loud the responses from Surveys
- d** Tallying on paper the responses from Surveys
- e** Making sure all tally information is put into Data Table

As in the collection-of-data phase, students can take turn handling these various tasks, and do this in the most accurate and amenable manner for the group members. There are many methods of handling the surveys, and cross-checking each other's numbers is a good way to increase accuracy.

- 2** By the time students are finished with the data, each member of the group should have a completed Table with all the information they collected. Under no circumstances should any of the surveys or tally sheets be recycled, or taken home by one gung-ho student to process the data for the entire group, until this is accomplished.. If students don't keep the surveys in their own classroom folders, create a space with boxes, folders, crates, or some other method for keeping this data available for all students in the group.
- 3** Each group should discuss with members, and then the teacher, which questions and answers they will graph and display for the whole class presentation and discussion. Depending on the age and ability level of the group and/or class, you might have them work on one or more of these questions. Since this often requires a great deal of data to be processed, it is best to err on the side of restraint. While it is interesting to process all the data, this phase is less exciting than the gathering of data, and students can become less-than-amicable within the group when trying to figure out what is important and what is not. *It is not necessary to graph all the data*, and while some students may want to do this, it will discourage those students who are overwhelmed by a lot of information at once. Encourage *those students who are capable to do so, and let those who are not do an excellent job with data from one interesting question that can show whether or not their hypothesis is correct.*
- 4** While processing/counting the data, make sure students remember to:
 - *Check off any question on any survey that was*

processed and accounted for in their Data Table, so it is not double-counted.

- Make a separate pile of surveys with answers that are hard to understand, as well as ones with heading categories that have obvious mistakes or missing information. For example, if the group is separating data by Male/Female, and the respondent checked both categories, this is outlier information and/or is unusable for their purposes.
 - Write down anything written in the “Other” category of answers, to be discussed later in the analysis and/or conclusion of their project write-up.
- 5** Groups will not finish data tabulating at the same time. Make sure you have graph paper, markers, and rulers ready for students to graph the results of at least one question, and possibly more, from their own data table. Groups should take responsibility to make a large version of one of the graphs on poster paper for later presentation to the class. Graphs should all include a descriptive title, labeled axes where appropriate, an appropriate scale, a key for symbols, designs or colors where appropriate, and data that is represented neatly using a ruler.

CONCLUSION & EVALUATION

(D) Present and Discuss

[One to two class periods]

- 1** After students have made their posters, discuss the results of their surveys. Refer back to the original three questions asked of the whole class at the beginning of the lesson, and in particular the first two:
 - “What do students and teachers in our school know about invasive species?”
 - “What do you think other people should know about invasive species?”At this point, students should definitely be able to answer the first question, which is the more literal. The results they gathered could be used to generate a display from their graphs with information to inform the general school population about what is known.
- 2** While looking at the survey results, discuss the teachers' and students' opinions regarding invasive species. This includes how serious they think the

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problem is, what concerns they have regarding the same, and how they would personally (or through societal choices) handle dealing with them both in and out of the classroom.

- 3 Students should write up an analysis and conclusion of their work. The analysis should have two parts, both addressing the quantitative (numbers from the graph) and qualitative (observations, outlier information, etc.) aspects of the work. The conclusion should include:
 - a Whether or not their hypothesis was correct and why,
 - b Why they think they got the results they did, and
 - c An error analysis of their work.

The depth of their write-up should be based on whether or not they are using this as a work sample, the age of the students, and the emphasis placed on the work as a process versus a product.

- 4 Please, share your results with the WISE program by contacting WISE_seagrant@oregonstate.edu. We would love to showcase on our Teacher Community website any materials or data your classroom produced.
- 5 Give us your feedback. The WISE program also has a survey where we are collecting feedback from teachers who use our curriculum. Please share your feedback by going to MenaceToTheWest.org and clicking on the “Give Feedback” button.

EXTENSION:

Students may want to work on an “educational outreach” activity displaying the results of their survey work; for example, an informative bulletin board, a brochure that can be reproduced and given to teachers, an article or series of articles within a school or District newsletter, or an addition to a school website.

Please share your results with the Sea Grant WISE Program (Watershed and Invasive Species Education). Go to MenaceToTheWest.org and click on “take action” and “share your project” to find out how.

We need your feedback. If you used all or parts of this lesson, please share your feedback by going to MenaceToTheWest.org and clicking on the “Feedback” button on the home page.

STANDARDS AND BENCHMARKS

Common Core

Mathematics

- Abrast and Quantitative Reasoning MP.2
- Strategic mathematic tool use MP.5

Reading: Informational Text (RI) (Grade 5)

- Integration of Knowledge and Ideas 5.7, 5.9

Science & Technical Subjects (RST) (Grades 6-8)

- Integration of Knowledge and Ideas 6-8.7, 6-8.9

Speaking and Listening (SL) (Grade 8)

- Comprehension and Collaboration 8.1
- Presentation of Knowledge and Ideas 8.4, 8.5

Writing (W) (Grade 5):

- Research to Build and Present Knowledge 5.7, 5.8, 5.9

Writing (WHST) (Grades 6-8)

- Write Informative/Explanatory Texts 6-8.2
- Research to Build and Present Knowledge 6-8.7, 6-8.8, 6-8.9

Next Generation Science Standards

Earth and Space Sciences (Grades 5-8)

- Earth and Human Activity 5-ESS3-1, MS-ESS3-3

Engineering, Technology, and Applications of Science (Grades 3-8)

- Engineering Design 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4

Life Sciences (Grades 6-8)

- Ecosystems: Interactions, Energy, and Dynamics MS-LS2-2

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