

Exploration of “Pillbugs”

Linda Heck

5th Grade Teacher

Dysart Elementary School

Ecology Explorers/ASU/Summer 2003

BRIEF DESCRIPTION: (Overview and Rationale)

These lessons will take approximately five days. It is a small section of a thematic unit written about insects, bugs, and arthropods. Although this topic is directly related to the Arizona State (*Life*) Science Standards, a rich strand of language arts and mathematics are woven throughout. This lesson uses the components of direct instruction, teacher modeling, observation, discovery and direct student involvement including participation in cooperative learning groups. Learners will be challenged and enlightened as they formulate a hypothesis, conduct experiments, and support their answers with reasoning skills. The objectives will be based on Bloom’s Taxonomy.

ECOLOGY EXPLORER PROTOCOL: ARTHROPODS

EFFECTIVE INSTRUCTIONAL STRATEGIES USED:

- *Venn Diagram
- *Brainstorming
- *Identification and Discovery
- *Cooperative Learning Groups (community building)
- *Journal Writing
- *Vocabulary Building
- *Illustrating
- *Group Game
- *Gathering Data
- *Student Invention
- *Formulating a Hypothesis
- *Summarizing and Group Presentation
- *Class Discussion

MATERIALS:

- *Individual list for each day
- *Appendices at end of lesson
- *books on arthropods to look at
- *Access to computer lab/Internet
- *book: The Pillbug Project: A Guide To Investigation by Robin Barnett (great resource for additional ideas)

STATE STANDARDS:

5.L.1 Classification of Organisms

PO 1. Construct a simple classification system based on physical characteristics

PO 2. Arrange organisms into a classification system

5.L.3. Populations and Ecosystems (4SC-E7a.)

PO 1 Describe the components of an ecosystem

PO 2. Describe how living and non-living things interact within an ecosystem

4SC-E7. Explain and model the interaction and interdependence of living and non-living

components within ecosystems

PO 1 Explain the role of living/non-living components in an ecosystem

N2-23 Apply mathematical operations in everyday situations

D1.1 Collect, organize and record data

D1.2 Create graphs, tables and charts

D2.1 Collect data with tallies

D3.4 Identify smallest, largest, and most often recorded, least often and middle using sorted data (mode, median)

D2.4 Discuss the probability

D5.2 Construct Venn diagrams

D5.10 Compute the mean and range

WE5-03 Provide written support through facts/details directly related to topic

WE3-04 Writes a clearly written summary

WE1-01, 02, 03, 04, 06 Uses correct spelling conventions, punctuation, and capitalization.

usage, and fluency

W-E8 Demonstrates research skills using references and sources appropriately

VOCABULARY:Hypothesis- to make a guess based on thinking something through carefullyArthropod- a group of animals that lacks backbones, has bodies in sections, and has jointed feetExoskeleton- a hard outer shell that supports an animal's body like a skeletonInsect- an arthropod with six legs and three body sectionsBug- an insect that does not have jaws for biting or chewing, instead they have special mouthparts for piercing and sucking up liquids.Abdomen- the rear section of an insect's bodyAntennae- sense organs found in pairs on the heads of certain animals such as insectsThorax- the middle section of an insect, where legs and wings are attachedSpecies- a group of animals with common traitsProtocol- a specific and constant way to collect data and carry out an experiment so that there is consistency among other science researchers

Characteristic- specific details that describe the specimen

Entomologist- a person who studies insects

Day One

Objectives:

- a. *The student will define words. (knowledge)*
- b. *The student will identify pillbug characteristics. (knowledge)*
- c. *The student will create a dichotomous key. (synthesis)*
- d. *The student will carefully examine the pillbugs and make observations. (application)*
- e. *The student will record observations. (comprehension)*

Materials:

- *Ziplock bags of plastic bugs for each cooperative learning group
- *Magnifying lenses
- *petri dishes
- *terrariums
- *pillbugs
- *Appendix A
- *Science Journals
- *rulers

Procedures:

1. Give each cooperative learning group a Ziplock bag with a sample of plastic bugs and allow them time to take the plastic bugs out and to touch them and observe them carefully.
2. After a time of observation, explain the definition of the word, “characteristic”. Choose an object in the room and model several words of phrases that give characteristics of the chosen object. Then, have children brainstorm characteristics of their plastic bugs. Allow several minutes for discussion and then take several answers from each group and write their brainstorms on the board for everyone to see and compare.
3. Use a baggie of plastic bugs and take them out. You will now demonstrate to the children how to make a dichotomous classification key. Begin by telling the students that they need to divide the bugs into two different categories. Ask them to look at the bugs and select traits that would divide them into two groups. Model how to divide them further and further until you have one at the bottom of each side of the key. This will be helpful for classification skills.
4. Have the students put the plastic bugs back in the baggies, but allow them to keep them on their desk. Now pass out the pillbugs. Each group should get a Petri dish with about four pillbugs inside of it. (Remember to keep the pillbugs moist so that they will be healthy.)
5. Allow students to observe the pillbugs and take them out of the petri dishes. Encourage students to use the magnifying lens and microscopes for more detailed investigation.

6. Now it's time to play a "bug" observation game. Each cooperative group will play together. The person with the longest hair at each table will start. They must say one characteristic that they observed about the pillbug. Go around the circle clockwise and each student will also do this. Keep going around in a circle naming characteristics until a student can no longer name any. This means that they are out and play continues without them. The last person standing is the winner at each cooperative learning group.
7. Pass out Appendix A for students to fill out as they observe the pillbugs.
8. After students are completed with the observation sheet, come together as a class and discuss the characteristics of the live pillbugs. Write your class brainstorms on the board and discuss the day's findings from this activity. Students are to summarize what they learned in their science journal. Make sure that students can label the pillbug at the end of this lesson. Define antennae, thorax, and abdomen and show children where these parts are.

Day Two

Objectives:

- a. *The student will define and discuss vocabulary. (knowledge)*
- b. *The student will design a pillbug playground that is adaptable for the pillbug. (synthesis)*
- c. *The student will discover the natural habitat of pillbugs. (application)*
- d. *The student will observe specific behavior of pillbugs and formulate a conclusion to their initial hypothesis. (application and evaluation)*
- e. *The student will construct graphs that reflect data. (synthesis)*
- f. *The student will record results and data. (comprehension)*

Materials:

- *Science Journal
- *terrariums
- *pillbugs
- *Appendix B
- *Coke flats
- *moist soil
- *materials from outside such as pebbles, wood, leaves, twigs, etc.
- *timer
- *graph paper

Procedures:

1. Review some of the observations from the pillbug activity from yesterday.
2. Explain that we are going to be scientists doing research and to conduct research appropriately; we need to have a protocol. Define this word and discuss why it would be important to have a protocol. Go over other definitions at this time such as arthropod, insect and bug. After this define species and have children name different animals and classify them according to these new terms.
3. Pass out the supplies to build the pillbug playground. Each cooperative group will need to make a playground for their pillbugs using Coke flats, moist soil, and items that they selected to make their pillbug feel at home. (leaves, bark, twigs,

etc.) Let the children choose what they think is best. They may choose to change or add things too. When students are done creating the playground, allow them to take the pillbugs out of their plastic terrariums and observe them in their new playground. They will always put their pillbugs back into the more permanent terrariums when completed with the daily activities and experiments.

4. The children are now going to conduct a little experiment to find out where pillbugs prefer to hide in their new habitat. First, make logical predictions about where they might be found. This would be a good time to discuss the word hypothesis because they will be making a hypothesis every day from now on. Ask students to look around at other group's playgrounds to see which objects they have in common that the pillbugs could hid under. As a class, they need to decide on four objects and make sure that each playground has exactly the same amount of each of these objects. Then, place the pillbugs in the middle of the playground and observe where they go and if and where they hide. Each time a pillbug goes underneath an item, keep track on Appendix B. Observation time will be 20 minutes to set a timer. Students should also note any other interesting observations in their Science Journal for later discussion.
5. At the end of 20 minutes, have students complete the graphing part of their data sheet on the Appendix and allow for class discussion. Compare graphs.
6. Tell children that they are now entomologist because they are scientists who are studying bugs!

Day Three

Objectives:

- a. *The student will discuss vocabulary words. (knowledge)*
- b. *The student will compare and contrast habitats of pillbugs. (analysis)*
- c. *The student will construct graphs that reflect data. (synthesis)*
- d. *The student will make reasonable predictions based on the data. (synthesis)*
- e. *The student will record observation and data. (comprehension)*

Materials:

- *Science Journal
- *pillbugs
- *pillbug playgrounds and terrariums
- *Venn Diagram pocket chart
- *index cards or sentence strips
- *graph paper

Procedures:

1. Remind students of the experiment done yesterday and the places where the pillbugs chose to hide more often than others. Now tell students that today, we will be going on a pillbug hunt around the playground to compare their natural environment to the one they created.
2. Explain the pillbug hunt that students are about to embark on. It is best to have students work in groups on the hunt on a day that you can arrange for parent volunteers or student aides to assist with the groups. This way you can spread out across the playground. It is important to have containers that will allow the

pillbugs to stay moist if you are collecting them to take back to the classroom. It might also be fun to have extra containers to collect insects for classification and observation back at class in the student's spare time.

3. Remind students to diligently work on Appendix C as they find the pillbugs.
4. Back in the classroom, discuss findings and observations. Define the word ecosystem and discuss the characteristics of the natural ecosystem where pillbugs were found. After that, discuss the characteristics of the pillbug playgrounds that the students created. As a class, create a Venn diagram comparing and contrasting the different ecosystems. This would be more of an interactive activity if you passed out sentence strips or index cards to the groups. They could use three different colors of cards for the three categories. Then, a representative from each group could come out one at a time and place one card in the appropriate pocket of the Venn diagram chart (draw a Venn diagram on the board and use tape for cards if you don't have a pocket chart in the shape of a Venn Diagram) until each group has run out of cards or all answers have been used.
5. Look at the graphs the students completed and make predictions about how this graph compares to where you found them in the natural ecosystem.
6. For an extension activity or for students who finish activities early, graphing the hiding places of the natural environment and reporting about findings would be welcome.

Day Four

Objectives:

- a. *The student will conduct three teacher generated experiments. (application)*
- b. *The student will make judgment calls regarding the experiments. (evaluation)*
- c. *The student will record results and data. (comprehension)*

Materials:

- *Science Journal
- *Graph paper
- *Appendix C
- *cotton swabs
- *peppermint extract
- *vinegar
- *lemon juice
- *fresh leaves
- *salt
- *sugar
- *timer
- *straws
- *pillbugs
- *pillbug playgrounds and terrariums

Procedures:

1. Today, we will be conducting three mini experiments that are teacher generated. In addition to finding out more information about the pillbugs, students will have

a better idea of how to set up an experiment, do observations and what to measure.

2. Pass out Appendix C and explain the three experiments to the students. They will be testing for three different things. The idea here is to introduce students to a stimulus that the pillbug might react to and record observations.
**first mini experiment-smell test- dip cotton swabs in: peppermint extra, vinegar, and lemon juice
3. Get your group's pillbugs and let them crawl around on your desk. Put the cotton swabs in front of each pillbug, one at a time. Then place the cotton swabs equal distance apart on your desk and the pillbugs in the middle. Observe them for ten minutes to see which swabs they go to the most. Keep track with tally marks on the Appendix.
4. **second mini experiment-taste test- now place four leaves on your desk with the following items sprinkled on them:
---two leaves should be sprinkled heavily with salt
---two leaves should be sprinkled heavily with sugar
5. It is important that each group place the leaves with salt diagonal from each other. The leaves that have sugar on them should be in the other diagonal corners. Make predictions about what you think will happen. Discuss as a class.
6. Place the pillbugs in the middle of the leaves and tally how many times they visit each leaf to see if they prefer salty leaves or sweet leaves. Observe carefully to see if you think the pillbugs are eating the salt and or sugar. Make sure students are recording any additional observations in their science journal as well as the Appendix activity. This should be a timed activity and students should use tally marks during a 10 minute period.
7. **third mini experiment- wind test/you will need straws
8. Provide each student with a straw. They are to place their pillbugs in the pillbug playground, but separate them so that they know the difference between the four pillbugs in their playground area. To conduct the wind test, students need to take turn blowing gently on each pillbug through the straw. It is important to blow on each pillbug the same amount of times. Each pillbug should be blown on exactly four times. The students should record observations of what the pillbugs do. Do they roll up or start walking, or something else. Are there any differences after a pillbug has been blown on once or do they always react the same way etc?
9. Students should make observations in their science journal as well as answering the questions on the Appendix.
10. After completing the three experiments and recording observations in science journals, come together as a class and discuss the three different experiments and the results. What did students learn from these experiments? Were results the same or different from group to group?

Day Five

Objectives:

- a. *The student will discuss and review vocabulary. (knowledge)*
- b. *The student will formulate his own experiment. (synthesis)*
- c. *The student will measure results and summarize the experiment. (evaluation)*
- d. *The student will interpret facts by writing and illustration. (comprehension)*

Materials:

- *Science Journal
- *pillbugs
- *terrariums and pillbug playgrounds
- *graph paper
- *various supplies that children decide upon

Procedures:

1. Students should now be more comfortable with handling pillbugs and setting up an experiment. In fact, today is a big graduation day for the kids as they will now set up their very own group experiment.
2. First, it is important to discuss the proper way to set up an experiment, what variables to set, and how to specifically conduct the experiment.
3. Give students some time to discuss with their cooperative learning group an experiment that they think would be valuable to conduct. They need to have a specific thing to measure and record. After students have had time to brainstorm, make sure they check with you to make sure that the experiment follows the scientific guidelines.
4. Some ideas for further experiments are: touching with cotton swab test, do they have a color preference, types of soil preference, do they like light or dark, etc. The students are encouraged to come up with their own idea.
5. Students will need to make a chart, keep track of observations, and present the information to the class in the form of a graph, illustration, and oral report. Students will record all of this information in their science journals.

CULMINATING ACTIVITIES:

1. Pass out the teacher made brochure on the pillbug along with the rubric. Walk through the pillbug brochure one page at a time to point out how the directions were followed. You may chose to have the children do this on the computer or just write on and illustrate the teacher made template. (Appendices D, E, F, G, and H)
We have just studied pillbugs for one week, so the teacher made example should be a nice review for the students. Their job is to select a different arthropod/insect/bug and made a new brochure to present to other students in the class.
2. Take students to the computer lab and do an excel graph demonstration lesson. Guide students thorough making a graph together step by step. Make sure they bring their student made graphs with them from the pillbug experiments from this week. Allow them time to make different types of graphs for each student made graph. For example, they need to be able to see the information in the form of a bar graph, line graph and pie graph. Then discuss which graph shows the information best for each graph and why you would choose a particular graph to show different types of information.

3. In addition to the above graphing activity, these lessons would be great place to review calculating averages. Have students select two graphs and show the class a way to find the range, mean, median and mode. They may have to gather additional information, but this is a necessary and useful math piece to add.
4. Go to the computer lab with students and have them go to:

<http://projects.edtech.sandi.net/grant/insects/index.htm>

This website is made specifically for children and allows them the opportunity to learn about the ant, cockroach, bee, and termite. Students would simply select one of these critters to learn more about and click on the appropriate links. They should take notes on their insect and come back to class to make an insect paper bag book. Fold up the bottom of the paper back and tuck it under the flap. Then, staple 10 sheets of paper under this folded area. Decorate the outside in the shape of the insect using construction paper and other supplies. Finally, use the pages inside as information pages to your insect book. Each page should have one fact and a picture and students will present these to the class.

EVALUATION AND ASSESSMENT:

All Appendices and Science Journals will be collected and graded as assessments. Teacher observation is also critical to these lessons.

LIST OF APPENDICES:

Appendix A	Characteristics Of A Pillbug
Appendix B	Pillbug Playground
Appendix C	Three Tally Charts For Experiments
Appendix D	Rubric For Critter Brochure
Appendix E, F, G, and H	Sample Brochure and Brochure Template (not labeled)
Appendix I	Bloom's Taxonomy (Referral Page)

**APPENDIX A
EXPLORATION OF PILLBUGS**

Characteristics Of A Pillbug

1. Define the word characteristic.

Now, carefully use the magnifying lens to observe the pillbugs.

2. List three adjectives that describe a characteristic of a pillbug.
 - a.
 - b.
 - c.
3. Measure a pillbug.
_____cm _____mm
4. Does it have any antennae?
5. How many segments does it have?
6. How many legs does it have?
7. Describe how it walks using a complete sentence. (how fast, forwards, stops a lot, etc.)
8. Illustrate a pillbug below labeling its parts correctly. Be as detailed as possible.

APPENDIX B
EXPLORATION OF PILLBUGS

Pillbug Playground

Congratulations! You have just created a pillbug playground. Now it's time to explore some more. Are you ready? Let's go!

You have probably already noticed that the pillbugs like to hide underneath things in their new playground. Well, this is also something that they do outside in their natural ecosystem.

1. Predict where you think you may find pillbugs outside. Next to each prediction, explain why you think this is a good place to find them.

*******PREDICTIONS**

- a.
 - b.
 - c.
 - d.
 - e.
2. Now, write about your findings.
3. We are now going to conduct a little experiment inside with our student created pillbug playgrounds. Select four items to keep in your playground that you think the pillbugs could hide under. You have 20 minutes to observe. Keep track of how many times pillbugs will visit your selected hiding places in 20 minutes.

Items Selected to Hide Under	tally marks	tally marks	tally marks
Item #1 _____			
Item #2 _____			
Item #3 _____			
Item #4 _____			

**APPENDIX C
EXPLORATION OF PILLBUGS**

Three Charts For Experiments

Experiment One:

TYPES OF SMELLS	TALLIES
vinegar swab	
peppermint extract	
lemon juice	

Experiment Two:

Salt Leaf #1	
Salt Leaf #2	
Sugar Leaf #1	
Sugar Leaf #2	

Experiment #3:

Observations of Pillbug Behavior

Pillbug #1	
Pillbug #2	
Pillbug #3	
Pillbug #4	

**APPENDIX D
EXPLORATION OF PILLBUGS**

Rubric For Critter Brochure

(5 POINTS PER EACH ITEM BELOW.....125 POSSIBLE POINTS...10 EXTRA CREDIT POINTS POSSIBLE)

PAGE ONE:

- ___ title/name of insect/arthropod/bug
- ___ colorful picture of creature
- ___ something about animal to get the reader's attention
- ___ conventions/neatness

PAGE 2:

- ___ acrostic poem spelled down the page and evenly spaced
- ___ facts are more than one word
- ___ interesting and well thought out
- ___ conventions/neatness
- ___ **picture (extra credit...up to five points)**

PAGE 3:

- ___ there are four true facts about the animal's **DESCRIPTION**
- ___ there are 5 adjectives listed about the animal
- ___ spelling conventions/neatness
- ___ **picture (extra credit...up to five points)**

PAGE 4:

- ___ a list of some things the animal eats
- ___ a complete sentence about what this animal eats
- ___ a fact about food...(example...predator, scavenger etc.)
- ___ colorful picture regarding food
- ___ conventions/neatness

PAGE 5:

- ___ country or geographical name of habitat is listed
- ___ a specific landform is mentioned (example forest, desert etc.)
- ___ at least one complete sentence
- ___ colorful picture relating to habitat
- ___ conventions/neatness

PAGE 6:

- ___ first and last name at bottom
- ___ colorful picture of something relating to the animal
- ___ 2-5 interesting facts that have not already been mentioned
- ___ conventions/neatness

Total Points _____

HABITAT

Where Is Their Habitat?

Pillbugs live all over the place. They are found in North America and other continents too! These critters are found in land habitats. They prefer to live in soil that is moist. Pillbugs also like places with leaves, grass and trees so that they can climb and hide. They are also found in dimly lit places.



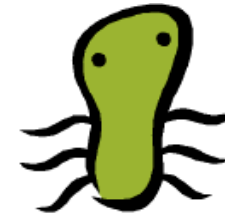
INTERESTING FACTS:

1. Other common names for this critter are: sow bug, roly poly, and potato bug.
2. A pillbug is 5-15 mm long.
3. Pillbugs shed their old skin and produce new skin. This is called molting.
4. Female pillbugs can produce up to 200 eggs.
5. Their legs are identical.

"Pillbugs"

By: Mrs. Heck

"Pillbugs"



"What are these mysterious creatures?"

ACROSTIC POEM



Places that
are moist
keep pill-
bugs

healthy

Isopod is its subgroup

Likes to be in the dark

Leaf litter is a favorite hid-
ing place

Born being self sufficient

Under rocks they like to
stay

Goes “hiking” or “rolling”

FOUR FACTS ABOUT THIS ANIMAL'S DESCRIPTION

1. segmented thorax
2. a set of antennae
3. seven pairs of identical legs
4. They roll into a ball when frightened or disturbed.



FIVE ADJECTIVES THAT

DESCRIBE THIS ANIMAL!

1. Robust!
2. Cold blooded
3. Dark colored
4. Curious
5. Moving

FOOD:

1. decaying wood
2. Leaves
3. Different types of vegetation

Sentence:

The pillbug is a land isopod that eats a variety of plants. This makes this critter an herbivore.



HABITAT

By:



ACROSTIC POEM

**FOUR FACTS ABOUT THIS
CRITTER'S DESCRIPTION**

**WHAT THIS
CRITTER EATS**

**FIVE ADJECTIVES THAT
DESCRIBE THIS CRITTER**

APPENDIX I
EXPLORATION OF PILLBUGS

BLOOM'S TAXONOMY

<u>KNOWLEDGE</u>	list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name: who, when, where, etc.
<u>COMPREHENSION</u>	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
<u>APPLICATION</u>	apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
<u>ANALYSIS</u>	see patterns, organize parts, identify components, analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, contrast, explain, infer
<u>SYNTHESIS</u>	Combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if, compose, formulate, prepare, generalize, rewrite
<u>EVALUATION</u>	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare specific details, summarize