GRADE: 1
ACTIVITY TITLE: Worm Watch / Voyons le ver de terre

KEY WORDS:	**MOTS CLÉS:**
shelter	abri
alive	vivant
environment	environnement
habitat	habitat
nutrients	nourriture
decompose	décomposer
castings	fumier
experiment	expérience
respectful	respectueux
humane	avoir de la compassion

INTRO: Activity involves students observing and asking questions about earthworms. Students investigate whether earthworms prefer damp or dry conditions.
(Lesson adapted from: More Picture Perfect Science Lessons, NSTA Press 2007)

INQUIRY TYPE: teacher initiated, partially designed; partially student designed, run and tested

MATERIALS RESOURCES:
In the Catalyzer:
disposable vinyl gloves X 10 pr
spray bottle X 4
paper plates (one per pair of students) X 10
aqua-terrarium X 1
Picture Book: "Diary of a Worm" by Doreen Cronin
Picture Book: "Wiggling Worms at Work" by Wendy Pfeffer

Provided by Teacher:
earthworms (one per pair of students) - 10
Purell (or soap & water)
hand lens (one per pair of students) - 10
paper towels
shoe box with lid (one per group of students) - 5/6
chart paper

Worm Bin:
garden or potting soil
sand
black paper
tape
shredded newspaper
shredded dead leaves or other organic matter

TARGET PROCESS SKILL: Inquiry - Experimentation (Plan & Conduct Investigations; Collect Data)

STRAND: Understanding Life Systems - Needs and Characteristics of Living Things

BIG IDEA:
Living things grow, take in food to create energy, make waste, and reproduce.
Living things have basic needs (air, water, food, shelter) that are met from the environment.
All living things are important and should be treated with care and respect.

ENGAGE:
Preparation:
1. Finding Earthworms: Earthworms can be purchased through a local bait shop. However, they can also be dug up from a shady, damp area. Scoop up the worms with as much of the soil from their home as possible. You can also look on the ground after a rain. If you want to keep a classroom worm bin for an extended period, then use red worms (i.e., red wigglers, or fish worms) as they are better suited to worm bins than night crawlers.

2. Preparing a Worm Bin: Use the aqua-terrarium provided or a clear plastic container with a ventilated lid (drill holes in the lid, or cover the container with netting, cheesecloth or nylon stocking). Cover the sides with black paper and keep in a cool, dark place until you need the worms. Refer to Background Information for additional information on maintaining the bin.

Part A: Begin the lesson with the diagnostic assessment outlined in the "EVALUATE" section (see below).

Part B: Read Aloud: "Diary of a Worm" by D. Cronin (This portion of the lesson may be done during a Language block of instruction.)

Pre-Reading:
- Begin by asking students if they have ever kept a diary or a journal.
- Brainstorm a list of things that might be found in a diary/journal (e.g., dates, Dear Diary, things they did, questions they have, other ideas, etc.). This could be the beginning of an anchor chart that lists text features of diaries.

During (and/or After) Reading:
(The following strategy and examples are taken directly from More Picture Perfect Science Lessons, NSTA Press 2007.)

- Questioning the Author Strategy (QtA) - this is a critical thinking strategy that encourages students to question the ideas presented in the text. (This is a very effective strategy to use in science as it helps to prevent students from getting misconceptions from the text or pictures.)

- Read the book to the students.
- Discuss with the class what the author's purpose was for writing the story (to entertain readers with a funny, imaginary story). Explain that we know that worms can't talk or wear clothes; however, the author did write some things about worms that did make you wonder.

Share some examples. Use sticky notes to mark off the corresponding pages with questions.

1. "March 20: When we dig tunnels, we help take care of the earth."

?? Do worms really make tunnels? Do they push with their heads like the worm in the picture is doing?

2. "March 20: Never bother Daddy when he's eating the newspaper."

?? Why would a worm eat newspaper? Do worms even have teeth?

3. "April 10: It rained all night and the ground was soaked. We spent the entire day on the sidewalk."

?? I see the sun in the picture. Do worms like to be in the sun? Do they prefer dry places or damp places?

4. "June 15: My older sister thinks she's so pretty. I told her that no matter how much time she spends looking in the mirror, her face will always look just like her rear end."

?? Is this true - a worm's head and tail look alike? How can you tell a worm's head from its tail?

After Reading:

- Explain to students that they are going to have an opportunity to be a scientist. Scientists are always asking questions, making observations and trying to find answers to their questions. Tell students that they are going to be investigating worms.

- Introduce the O-W-L organizer. Refer to TM-2: O-W-L (Chart/Handout). (You may choose to have a whole class O-W-L chart as well.)
- Explain that scientists must keep a record of their questions and observations by drawing and writing. Students should record any wonderings/questions that they have about earthworms at this time, in the appropriate section of the chart.

EXPLORE:
Preparation: Each pair of students will need a paper plate, hand lens, and the O-W-L Charts from before.

- Show students the worm bin. Explain how you set up and maintain the bin. Pull back the black paper to allow students to observe the tunnels made by the worms.
- Explain to students that as scientists they will need to collect information about worms. Discuss how students can you use their senses (sight, smell, touch), as well as make measurements to gather information. Students will also use the hand lens to make some initial observations. All observations should be recorded under the "O" on their O-W-L chart. Any questions or wonderings they have should be written under the "W". (You may want to emphasize measuring the worm using non-standard units - e.g., worm is longer then my pencil.)

(At this point, you may want to remind students of the questioning and observing skills that they worked on previously. Refer to STAGE 1 lessons of the Smarter Science program to review these skills and how they were developed.)

- If during this activity students find answers to their questions, they should be encouraged to record what they have learned under the "L".

- Remind students that worms are living things and should be treated respectfully. Discuss what this means. Inform students not to touch or handle the worms too frequently because worms dry out if handled too much.

- Give each pair of students an earthworm on a paper plate. Students should carefully observe their earthworm and record information on their O-W-L charts.

EXPLAIN:

- As a class, have pairs of students share their observations and questions, and record responses on a class chart. Record any learnings under the "L".

- Review the needs of living things (i.e., air, water, food & shelter). Discuss that the habitat of a living thing helps to meet those needs.

- Explain to students that scientists can't always answer their questions by observing. Often scientists need to design experiments or tests in order to answer their questions.

- Refer back to the book, "Diary of a Worm". Tell the class, that you remembered reading in the book: "April 10: It rained all night and the ground was soaked. We spent the entire day on the sidewalk." Remind students about the question you had after reading this section: Do worms prefer dry places or damp places?

- Discuss with the class that you couldn't find the answer to this question just by observing a worm on a paper plate. Tell students that you might have a prediction or guess about the worm's preference based on what you know about worms, but you really wouldn't know the answer unless you did an experiment or test.

- Show students the materials you have for your test: shoe box with lid, paper towels, spray bottle of water. Use a Think-Pair-Share strategy to have students think about how they could humanely test whether earthworms prefer damp or dry places (i.e., think independently first, discuss with a partner, share as a whole group).

- As a class, generate a list of steps to follow. (This should be done as a shared writing activity.) Refer to TM-3: Sample Procedure (Reference) for a list of possible steps. Note that there are 2 sample procedures listed on the handout. The first procedure does not take into account a fair test. This is probably what the class will develop. Prompt students to consider what needs to be done to make the test fair. (The second procedure is modified to demonstrate a fair test.)

  Teacher Prompt: *As I am re-reading through my steps and looking at the materials we have, I have a concern. If I fold or scrunch the damp paper towel into the box differently then the dry paper towel, will I be able to say which area the worms have a preference for? That doesn't seem fair. What can I do to ensure that my test is fair?*
- Prompt students to realize that the paper towels must be the same size and must be distributed in the box evenly. Go back and adjust the procedure to reflect this change. (Refer to the second procedure on TM-3.)
- Reiterate to students the importance of doing fair tests.

  Teacher Prompt: *In order for scientists to be able to measure results of experiments, tests must be fair. Only one thing can change and the rest must stay the same. For our experiment, we are changing the dampness of the paper towels. Everything else must be the same (i.e., type of paper towels, size of paper towels, location in box, time the worms are in the box, etc.).*

EXTEND:
Part 1 - Have students, in groups of 3-4, carry out the experiment. Students should compare their results to others and discuss possible reasons for any differences in their data. Results should be recorded under the "L" of their O-W-L chart.

Part 2 - Groups should design their own experiments to investigate a testable question that they have recorded on their O-W-L chart. Sample testable questions include: Does an earthworm move headfirst or tail first more often? Do worms prefer different types of food? Do worms react to strong smells? Do worms perfer light or dark?

Additional Activities:
1. Students should also be provided time to find answers to their own questions (some could be answered by observing, testing and/or researching).

2. Read Wiggling Worms at Work by Wendy Pfeffer and have students listen for answers to any of their wonderings.

3. The last page of the "Diary of a Worm" reads: "August 1: The earth never forgets we're here." Students should have an opportunity to explore how worms help the earth by completing the following investigation: Which plant will grow bigger and better: one planted in regular soil or one planted in soil enriched with worm castings? In order to successfully complete this investigation, students will need to identify control variables (things to keep the same for a fair test..e.g.,type of plant, size of plant, size of pot, amount of water, amount of soil, same temperature, same amount of light) and what to measure (e.g., height of plants, number of leaves, etc.). Use page 33 of "Wiggling Worms at Work" by Wendy Pfeffer for help with setting up the experiment.

EVALUATE:
Diagnostic
- Activate and assess prior knowledge using a Think-Pair-Share or Say & Switch instructional tactic. (Refer to TM-1: Say & Switch Description (Reference) for more information.) Place students into pairs. (Each pair should be numbered off - Partner A and Partner B.) Pose the following question to the class: "What do all living things need to survive?"
- Have Partner A respond first while Partner B listens. Pairs should switch roles on the teacher's command (so that Partner A listens, while Partner B switches).
- Select sample pairs to share with the whole class what they were discussing. Summarize the ideas of the class. (Do not correct any misconceptions at this time.)

Formative
- The teacher should review and respond to the work of each student as they progress through the lesson.
- Students should record their observations and questions on their O-W-L charts. (The skills of observation and questioning were emphasized in Stage 1 of the Smarter Science program. The quality of observations and

questions can be used as diagnostic information as well as formative. Provide suggestions to students about how these skills could be improved.)

- As students work through the "Extend" section to develop experiments to answer their own questions, teachers should observe student work, dialogue about their ideas and plans, as well as provide specific feedback to improve learning.

Possible Student Conference Questions:

- Are earthworms living creatures? How do you know?
- How does the earthworm's habitat meet its needs for survival?
- What did you learn about earthworms and what is your evidence (i.e., how or where did you find the information)?
- How do scientists find answers to their questions?
- What was one question you listed on your O-W-L chart that you didn't find the answer to? How would you go about finding the answer to this question?

BACKGROUND INFORMATION:

Worms belong to a class of creatures called annelids or "ringed" creatures. An annelid is a creature with a cylindrical body which is segmented both outside and inside. (Worms aren't insects because they don't have six legs, and they are not snakes because they don't have a backbone.) Worms have little bristles (called setae) on the underside of each segment which allows them to twist and wiggle forward or backward. An adult worm is around 20 cm long and has 100-200 segments along its body. The brain, 5 pairs of hearts, and breathing organs are located in the first few segments of the worm. The rest of the inside of an earthworm is filled with the intestines, which digest its food. The anterior or head end, is more pointed and narrow. The head end usually goes forward first. The mouth is covered by a flap (called the prostomium) which helps the earthworm sense light and vibrations. (Refer to TM-5: Worm Diagram (Reference) for a labelled diagram of the earthworm.)

Although each earthworm is hermaphroditic (having both male and female reproductive systems), it takes two worms to mate and reproduce. The reproductive organs are in the clitellum (the enlarged segments in the middle of an earthworm). The clitellum later forms a cocoon which protects the developing eggs.

Earthworms help the Earth in different ways. They force their way through soft earth, but must eat their way through harder soil. The soil a worm eats passes through the worm's digestive system and is deposited on the ground's surface as castings. Castings improve the ability of the soil to grow plants. Earthworms also turn rotting plants and animals into rich fertilizer. As worms burrow through the soil, they create spaces for air and water to penetrate. (Bosak, S. "Science Is", 1991)

Worm Bins: Worm bins can be made from clear plastic storage containers, large glass jars or small aquariums. The container needs a secure, ventilated lid (allows air to circulate without allowing worms to climb out). Drill holes into the lid, or use netting, cheesecloth, or nylon stocking. Fill the container with garden or potting soil. Mix in sand or peat moss so the soil won't pack. Use the spray bottle to sprinkle the soil with some water (the soil should be damp not soggy). Cover the top of the soil with shredded newspaper or dead leaves. There should be enough organic matter in the soil for the worms to eat for at least a week. Stir in more organic matter (shredded dead leaves, fruit or vegetable scraps) as needed. To simulate underground conditions, cover the sides of the container with black paper and keep the bin in a cool place out of direct sunlight. Commercial worm bins can also be bought from such places as Cathy Composters (www.cathyscomposters.com).

LOOK FORS:

Students are:

- making use of several senses in observing the worms (Stage 1 Skill)
- identifying differences of detail about earthworms compared to other living things (Stage 1 Skill)
- asking questions about worms (Stage 1 Skill)
- suggesting how answers to questions can be found (Stage 1 Skill)
- beginning to differentiate between testable and non-testable questions (Stage 1 Skill)
- with guidance, planning a simple fair test by identifying the variable that has to be changed and the things that should be kept the same (Stage 2 Skill)

- beginning to identify what to look for or what to measure to obtain a result in an investigation? (Stage 2 Skill)
- with guidance, recording information and results by drawing pictures and/or using words (Stage 2)

SEQUENCE (where in the unit does this lesson best fit?):
Students should have an understanding of the basic needs of all living things before beginning this lesson.

TEACHING STRATEGIES:
Think-Pair-Share
Say and Switch
Numbered Heads
Modified version of Questioning the Author (QtA)
O-W-L Organizer

SAFETY:
Students must wash their hands with soap and water after handling the earthworms. You may want to have students wear disposable gloves.

Worms are living things and need to be treated with respect. Ensure that worms do not become dehydrated, are not too hot or cold, and are not handled roughly. The Thames Valley District School Board has very high standards about the treatment of living things in the classroom setting and it is essential that these standards are maintained throughout the course of the project. For more information about current policies, please refer to the Thames Valley District School Board website. (Live Animals in the Classroom http://www.tvdsb.on.ca/policies/policies.shtml)

BLACK LINE MASTER[S]:
TM-1: Say & Switch Description (Reference)
TM-2: O-W-L Organizer (chart / student handout)
TM-3: Sample Procedure (reference)
TM-4: Worm Booklist (Reference)
TM-5: Worm Diagram (Reference)

TEXT REFERENCES:
Refer to TM-4: "Worm Booklist" (Reference) for nonfiction and fiction book titles related to worms.

<u>Read Alouds / Shared Reading</u>
"Living Things Need Food" (Windows on Literacy Level 10) National Geographic ISBN: 792243129
"Animal Homes" (includes Homes in the Ground, Coral Reef, Nests, Nests, Nests, Busy Beavers & Animal Homes) (Science Resource Centre) Scholastic ISBN: 1552687732

<u>Guided / Independent Reading</u>
"Living Things Need Water" (Windows on Literacy Level 4) National Geographic ISBN: 792292111
"Where Animals Live" (includes Bees Live in Hives, Frogs Live on Logs, Snakes Live in Gras, Owls Live in Trees, Fish Live in Water, and Polar Bears Live on Ice) (Time To Discover Readers) Scholastic ISBN: 439473942
"You See With Your Eyes" (Time to Discover Readers, Kindergarten) Scholastic ISBN: 439567017
"You Smell With Your Nose" (Time to Discover Readers, Kindergarten) Scholastic ISBN: 439567017
"You Taste With Your Tongue" (Time to Discover Readers, Kindergarten) Scholastic ISBN: 439567017
"You Touch With Your Fingers" (Time to Discover Readers, Kindergarten) Scholastic ISBN: 439567017
"Your Five Senses" (Time to Discover Readers, Kindergarten) Scholastic ISBN: 439567017

Science & Tech Curriculum Expectations:
1.1 identify personal action that they themselves can take to help maintain a healthy environment for living things, including humans
1.2 describe changes or problems that could result from the loss of some kinds of living things that are part of everyday life
2.1 follow established safety procedures and humane practices during science and technology investigations
2.3 investigate and compare the physical characteristics of a variety of plants and animals, including humans
2.6 use appropriate science and technology vocabulary, including *investigation, explore, needs, space,* and *food*, in oral and written communication

3.1 identify *environment* as the area in which something or someone exists or lives
3.2 identify the physical characteristics of a variety of plants and animals
3.5 describe how showing care and respect for all living things helps to maintain a healthy environment
3.6 identify what living things provide for other living things
3.7 describe how the things plants and animals use to meet their needs are changed by their use and are returned to the environment in different forms

Mathematics Curriculum Connections:
* measuring the earthworm and paper towel size
1m28 estimate, measure, and describe length, area, mass, capacity, time, and temperature, using non-standard units of the same size
1m30 demonstrate an understanding of the use of non-standard units of the same size for measuring
1m31 estimate, measure, and record lengths, heights, and distances
1m32 construct, using a variety of strategies, tools for measuring lengths, heights, and distances in non-standard units

Language Curriculum Connections:

* working in whole group, small group and partner activities
1e5 Active Listening Strategies 1.2 demonstrate an understanding of appropriate listening behaviour by using active listening strategies in a few different situations
1e14 Interactive Strategies 2.2 demonstrate an understanding of appropriate speaking behaviour in a few different situations, including paired sharing and small- and large group discussions
1e15 Clarity and Coherence 2.3 communicate ideas and information orally in a clear, coherent manner
1e16 Appropriate Language 2.4 choose appropriate words to communicate their meaning accurately and engage the interest of their audience

* listening to Read Aloud
1e6 Comprehension Strategies 1.3 identify a few listening comprehension strategies and use them before, during, and after listening in order to understand and clarify the meaning of oral texts, initially with support and direction
1e9 Extending Understanding 1.6 extend understanding of oral texts by connecting the ideas in them to their own knowledge and experience; to other familiar texts, including print and visual texts; and to the world around them

* completing O-W-L chart
1e51 Classifying Ideas 1.4 sort ideas and information for their writing in a variety of ways, with support and direction
1e54 Form 2.1 write short texts using a few simple forms

Say and Switch

(Grades K to 12)

(Cooperative Learning, page 204 Barrie Bennett - Carol Rolheiser - Laurie Stevahn)

Description

- a cooperative structure in which partners sequentially take turns responding to a question or discussion topic at signalled (and sometimes unpredictable) intervals.

Procedures

Step 1 Place students into partners.

Step 2 Identify the discussion topic.

Step 3 Identify the signal when roles will switch.

Step 4 Cue first partner to respond to question/topic.

Step 5 First partner shares while the second partner listens carefully.

Step 6 Use the signal to switch roles so the other partner shares while the first partner listens.

Step 7 Several switches may take place throughout the period of time allotted for discussion.

Prior Knowledge Required

- content for discussion
- active listening skills
- taking turns

Classroom Management Considerations

- remind students to use appropriate voice volume so others can hear their partner
- thought should be put into placement of partners around classroom
- thought should be put into who will work well as partners in this situation

Materials

- bell or some kind of noise-maker to signal the switch

Key Benefits	Effective Uses	Extensions / Modifications
• fosters oral communication skills and active listening skills • promotes student participation	• use as a structure for reviewing, rehearsing, or checking for understanding	• at the end of the session, have students summarize their partners' thoughts or their own thoughts orally with the class or in written form as a check for understanding • in Step 6 when the switch occurs, the challenge is for the second partner to complete or continue the first partner's line of thought before introducing new ideas

Teacher Notes and/or Reflections:

This handout is taken from: **Instructional Strategies for K to 12** *"Strategies for Teaching"* Recipe Cards - T.V.D.S.B., 2005-2006.

O - W - L

What do you OBSERVE about the object?	What do you WONDER about the object?	What did you LEARN about the object?

Sample Procedure

1. Wet one piece of paper towel.

2. Place the wet piece of paper towel on one side of the shoe box.

3. Place the dry piece of paper towel on the other side of the shoe box. Leave the paper towels about 2 cm apart.

4. Place 2 earthworms in the space between the paper towels, and close the lid.

5. Wait approximately 10 min.

6. Remove the lid and observe the location of each of the worms.

7. Repeat the experiment using 2 "fresh" worms.

Modified Sample Procedure

1. ***Cut 2 pieces of paper towel the same size. (Ensure they cover the same area of the box.)***

2. Wet one piece of paper towel.

3. Place the wet piece of paper towel on one side of the shoe box.

4. Place the dry piece of paper towel on the other side of the shoe box. Leave the paper towels about 2 cm apart.

5. Place 2 earthworms in the space between the paper towels, and close the lid.

6. Wait approximately 10 min.

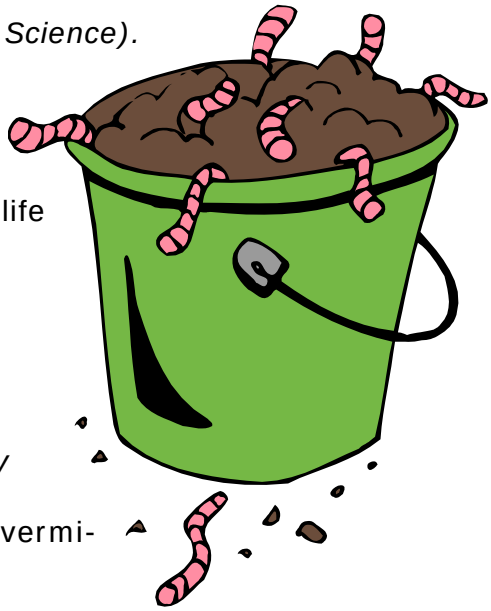
7. Remove the lid and observe the location of each of the worms.

8. Repeat the experiment using 2 "fresh" worms.

(Adapted from: More Picture Perfect Science Lessons, NSTA Press 2007)

Books about Worms

NONFICTION



Fowler, Allan. *It Could Still Be a Worm (Rookie Read-About Science).*
A simple introduction to the earthworm, roundworm, flatworm, and other kinds of worms.

Glaser, Linda. *Wonderful Worms.*
Describes the physical characteristics, behavior, and life cycle of the common earthworm.

Himmelman, John. *An Earthworm's Life (Nature Upclose).*
Describes, in simple text and illustrations, the daily activities and life cycle of the earthworm.

Kalman, Bobbie . *Squirmy Wormy Composters (The Primary Ecology Series).*
Shows children how to set up and care for their own vermi-composter. Worm bodies and their lifecycle are also explained.

Pfeffer, Wendy. *Wiggling Worms at Work (Let's-Read-and-Find-Out Science 2).*
Explains how earthworms eat, move, and reproduce and how they help plants to grow.

FICTION

Caple, Kathy. *Worm Gets a Job.*
Worm attempts various jobs for his animal friends so that he can buy painting supplies and enter the art contest.

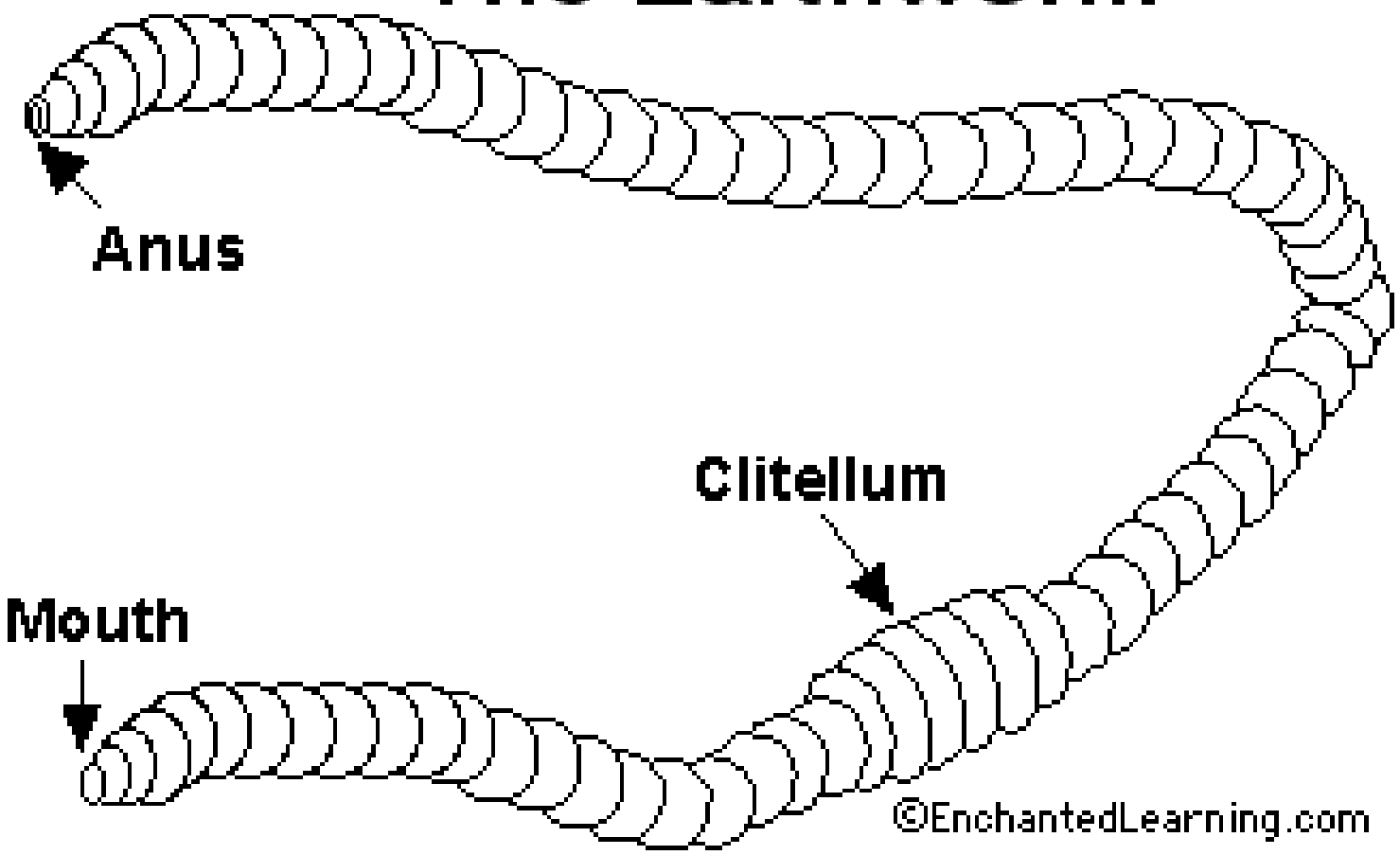
Cronin, Doreen. *Diary of a Worm.*
Through daily observations, a young worm discovers that there are some very good and some not so good things about being a worm in this great big world.

Kaczman, James*. . A Bird and His Worm.*
A bird who does not like to fly becomes good friends with a worm, and together they set out walking south for the winter.

O'Callahan, Jay*. Herman and Marguerite: An Earth Story.*
An earthworm and a caterpillar become friends and work together to bring a neglected orchard back to life.

Raschka, Chris*. Wormy Worm (Thingy Things).*
As Wormy Worm wiggles and woggles, it is hard to tell which end is front and which end is back.

The Earthworm



GRADE: 1
ACTIVITY TITLE: Invention Convention / La convention de l'invention

KEY WORDS:	**MOTS CLÉS:**
invention	une invention
product	un produit
materials	des matériaux
modification	une modification
improvement	une amélioration
limitations	les limites
planning	la planification
testing	mis à l'essai
solution	la solution
problem	le problème
benefits	les avantages
risks	les risques

INTRO:
Students will explore the processes of technological problem solving by improving on an existing object using everyday materials.

Lesson adapted from:
More Picture Perfect Science Lessons, NSTA Press 2007
Houghton Mifflin Education Place, www.eduplace.com
Science Net Links, www.sciencenetlinks.com

INQUIRY TYPE: teacher initiated, partially designed; partially student designed, run and tested

MATERIALS RESOURCES:
In the Catalyzer:
aluminum pie tins (1 per group of 3/4 students) = 5
standard plastic frisbees X 1 (teacher may want to provide additional standard frisbees)
Orbit Woomera Foam Flying Ring X 1
Rhino Skin Disc X 1
picture book: Imaginative Inventions by Charise Mericle Harper

Provided by Teacher:
optional: other "new & improved" versions of flying discs (or pictures of them) e.g., foam flying disc, the Glow in the Dark Frisbee, Aerobie ring, Rhino Skin disc, etc.
sticky notes
chart paper/large paper with placemat templates
may want to have other examples from the book "Imaginative Inventions" (e.g., eyeglasses, high-heeled shoes, roller skates, paper bags, marbles, piggy bank, etc.)
unsharpened pencils
erasers

Building Materials:
(Note : This list is not meant to be exhaustive. The goal is to provide students with a variety of materials with which to construct with.)
recyclable materials (e.g., plastic containers, cans, plastic lids, cardboard, toilet paper/paper towel rolls, etc.)
adhesives (e.g., glues, fasteners, scotch tape, masking tape, double-sided tape)
paper (e.g., construction paper, corrugated paper, tissue paper)
pipe cleaners
twist ties
straws
elastics
popsicle sticks, toothpicks and/or bamboo skewers
styrofoam

plasticine
empty spools
scissors
single hole punch

TARGET PROCESS SKILL: Technological Problem Solving (Develop Possible Plans; Select & Carry Out the Plan)

STRAND: Structures & Mechanisms - Materials, Objects & Everyday Structures

BIG IDEA:
Objects have observable characteristics, and are made from materials.
Materials have specific properties.
An object is held together by its structure.
The materials and structure of an object determines its purpose.

ENGAGE:
(Part 1 of this section requires a large, open area such as a gymnasium or school yard.)

Part 1:

- Show students an aluminum pie tin. Use a Think-Pair-Share or Say and Switch strategy (refer to TM-1) to have students think about all the different ways they could use the tin. Accept all responses.

- If the idea doesn't come up, demonstrate how the tin can be used as a frisbee. Allow students, in groups, to use the tin as a Frisbee. (You may need to demonstrate technique for flying frisbees as students may struggle with flying this disc.)

- After a short period of time, discuss as a class the structure of the disc as well as the material it is made of and how it impacts its flying ability (e.g., it is round, smooth, light). Also examine the benefits and risks of using this device. (Examples of possible student responses: Benefits: fun, entertaining, exercise; Risks: hit someone in the face; lose it; not very durable.)

- Use the Say and Switch strategy again (TM-1) to have students think about how the choice of materials and structure of the disc could be changed to improve the function of the Frisbee.

Teacher Prompt: *I wonder how we could improve this Frisbee so it would fly better. What other materials could we make the frisbee out of? How could we change its shape or structure to improve its flight?*

- Highlight the evolution of the Frisbee by showing the different designs (i.e., from pie tin, to plastic discs, to lightweight foam versions, skin discs, etc.). Discuss the material choice and structure of each of the new and improved discs.

- If there is enough equipment, you may want to allow students an opportunity to test the different versions of the discs and compare them to the original Frisbee.

Part 2:
Read Aloud: "Imaginative Inventions" by Charise Mericle Harper

(The following strategies and examples are taken directly from More Picture Perfect Science Lessons, NSTA Press 2007.)
(This portion of the lesson may be done during a Language block of instruction.)

Preparation: Select several of the inventions from the book ahead of time to read to the class. Mark these pages with sticky notes.

Pre-Reading:
To activate prior knowledge, ask students the following questions:
a) What is an invention? (something made to meet a need or solve a problem)

b) What do inventors do? (they think about people's needs or problems and come up with a solution)

During Reading:

"Stop and Jot/Draw"

- Read the pre-selected two-page spreads. As you read, leave out the name of the invention and instead say "this invention" or "this object". Allow students an opportunity to infer the identity of each invention by using clues presented in the reading and the pictures. Students should "stop and jot" (or depending on their capabilities, draw) their guesses on sticky notes as you read.

- Reveal the identity of the invention after the description is read. Students should attempt to identify the need that the invention filled.

Post Reading:

- Use the Think-Pair-Share strategy to have students discuss what they think is the greatest thing ever invented.

EXPLORE:

- Distribute one or two additional sticky notes to each student. Challenge students to find something in the classroom that was invented to solve a problem, or to make a task easier. Have students write their own name on the sticky note(s) and tack it to the object that they have found.

- In partners, have students talk about the object they selected, explaining the problem that it solves. Students should also examine the materials that the object is made from and how these materials help it to fulfill its purpose.

- Reconvene as a large class, and share a few examples.

EXPLAIN:

- Explain that sometimes inventors think of new ways of making older inventions even better. Refer students back to the Frisbee and its evolution from pie tins to plastic discs.

- Inform students that you have a problem that you would like to solve. Explain that you repeatedly lose your pencil when it rolls off your desk. You would like some help in coming up with a solution to this problem.

Teacher Prompt: *Every time I set my pencil on my desk, it rolls right off the edge. It is very frustrating! I wonder how we could modify or change the pencil to prevent this from happening? How could the pencil be improved so it will no longer roll off my desk?*

- Have students brainstorm a variety of ideas as possible solutions. Encourage them to be creative and inventive. Accept and record all ideas on chart paper.

- Explain to students that inventors and engineers, after they have generated a list of possible ideas, must consider issues or limitations, when selecting one design to plan and build. They may not be able to build every design that they think of. Sometimes they need to change their designs due to a lack of time or space, or due to safety concerns. They must work to find the design that will work best given the time, materials, tools, money and space available to them.

- Refer the class back to their list of ideas for improving the pencil. Discuss with the group which choices may be more viable (capable of working successfully) based on the limitations of time, materials and safety.

Teacher Prompt: *Let's look at our suggested ways for improving the pencil. Why don't we put a check mark (✓) beside those suggestions that are "can do now" - the ones we could safely build today? Are there any that we couldn't do today because of the materials that would be needed, or the amount of time required? For those that are "can't do now", we'll mark with an 'X'.*

- Distinguish between those solutions that are "can do now" and "can't do now".

- Choose one of the viable options (a "can do now" solution) and discuss how this could be built using the materials provided in class.

EXPLORE:

- Inform students that they are going to have an opportunity to design and build an improved pencil based on a problem that they themselves have encountered when using pencils.

- Using a think-pair-share strategy, have students think of a pencil problem that they have had to deal with. Prompt students by asking these questions:
  Is there anything frustrating about a pencil?
  Have you ever had a problem working with a pencil?

(Students may need to use a pencil to help generate ideas.)

- Generate a class list of potential pencil problems and record these on chart paper. Accept and record all student ideas. (Possible examples: pencil rolls off desk, eraser always wears out first, pencil always gets lost, pencil won't stay sharpened, pencil hurts the inside of your finger, lead gets on your fingers, you accidentally poke yourself with the sharp end, pencil breaks, doesn't taste good when you chew on it, pencil's not heavy/thick/strong/long enough, etc.)

EXPLAIN:

Preparation: Students will be working in groups of 3. Each group will need a piece of chart paper pre-divided as a placemat. (Refer to TM-2: Placemat Recipe Card (Reference) for additional information about this instructional strategy.)

- Place students into groups based on the type of pencil problem they would like to solve. In the centre of the placemat, record using pictures and words the pencil problem trying to be solved.

- In their own section of the placemat, students will individually brainstorm modifications/improvements that could be made to the pencil in order to solve the problem. They should use their imaginations and be creative. Students should draw and/or write their ideas. They should be able to explain how their pencil is improved, and what materials they would use to make the necessary changes.

- After a short period of time, each student should have an opportunity to share their ideas within their group. After everyone's ideas have been heard, the group should decide on the "can do now" solution. This should be added to the centre of the placemat.

- Each group should present this solution to the entire class (i.e., they should explain what the original pencil problem is, how the pencil will be modified/improved, what materials will be used to make the changes.)

- Use these questions to initiate discussion between groups during the presentations (i.e., have students consider limitations of the design they have selected).

1. Materials:
What materials will you need in order to make your design(s)? What tools will you need?
Are the materials and tools available? If not, can we get them? How?
Will the choice of materials affect the function of the pencil? How?

2. Safety:
Could you get hurt working with the tools and materials you have chosen? How?
What would we need to do to keep you and the rest of the class safe? Do we have enough people and materials to use this safety plan?

3. Time:
How long will it take you to build your design? Do you have enough time?

- Based on presentations and information shared between groups, allow groups an opportunity to reflect on their chosen design and make changes as needed. Ask students to decide whether they are able to build their design right here and now? Have them defend their choice.

EXTEND:

- Allow students time to try to create their improved pencils. Each group should work with an unsharpened pencil, and should have access to a wide variety of appropriate materials and tools. They should be encouraged to select only those materials that best suit their designs.

- When designs are complete, have groups present their new pencil to the class, reflecting on the success of their design and what they would do differently next time.

Additional Activities:
Have students brainstorm an everyday problem that they would like to solve. Students should develop a possible solution for this problem.

EVALUATE:

Diagnostic
- Activate and assess prior knowledge during large group class discussion related to the frisbee (refer to Engage Section - Part 1 for the sequence of the activity as well as sample guiding questions). Use a Think-Pair-Share or Say & Switch instructional tactic. (Refer to TM-1: Say & Switch Description more information.) Place students into pairs. Each pair should be numbered off - Partner A and Partner B. Pose the following question to the class: How could the choice of materials and structure of the disc be changed to improve the function of the Frisbee?
- Have partner A respond first while Parnter B listens. Pairs should switch roles on the teacher's command (so that Partner A listens, while Parnter B switches).
- Select sample pairs to share with the whole class what they were discussing.
- Then proceed to demonstrate the evolution of the frisbee. Discuss the material choice and structure of the new and improved frisbees.

Formative:
- The teacher should review and respond to the work of each student as they progress through the lesson.
- The teacher will observe and gather anecdotal evidence of student understanding of the technological problem-solving process.
- Conference with students at the end of the project about how they used tools, fasteners and materials, how they carried out their plan and have students evaluate their pencils. Possible conference questions could include:
  - Were you able to build your pencil exactly as planned? Why or why not?
  - Did the process of building the pencil change your mind about what you "can do now"?
  - If you had it to do over again, what would you change? Why?

BACKGROUND INFORMATION:
The technological design process has students identify a problem or need, design a solution, implement a solution, evaluate a product or design, and communicate the design process.
Students should be given many opportunities to design and make things using a variety of materials and simple tools. The familiarity of the pencil allows students to propose a variety of ideas on how to improve it.

Generally children design and build based on their first idea with little testing. Students must be encouraged to reflect on their designs. Try not to judge student designs as "good" and "bad" or "possible" and "impossible." Using terminology such as "can do now" and "can't do now", reminds students of the purpose of the activity to design something that they can actually make within the space and time allotted, using available materials.

History of the Frisbee - Early 1900s in Bridgeport, Connecticut, William Russell Frisbie owned and operated a pie bakery. His factory workers reportedly broke up their workday by having a game of catch with the pie tins. The metal tins (heavier than the aluminum tins used today) were a bit dangerous, but it was undoubtedly fun. The news of flying pie tins spread to nearby Yale University, where students quickly caught on to the fad. Later out in California, Walter Frederick Morrision designed a saucer-like disc for playing catch. A company named Wham-O produced these discs, only to find the plate-tossing game at Yale. So Wham-O adopted the name Frisbee for its flying disc toy.

LOOK FORS:
Students are:
- beginning to recognize a practical problem in their immediate environment (e.g., a pencil that rolls off the desk) (STAGE 1 skill)
- brainstorming with the class possible solutions to the practical problem, and reaching consensus on one solution to implement (STAGE 2 Skill)
- developing with the class a plan to solve the practical problem (identify simple steps to follow), and following the plan

(STAGE 2 Skill)
- developing as a class, limited criteria to evaluate an object or device based on its function (STAGE 3 Skill)
- identifying materials to be used, and with guidance, using appropriate equipment to measure, construct and test simple models and devices (STAGE 2 Skill)
- with guidance, recording and organizing information and results using drawings, simple tables (e.g., tally), graphs and/or words (STAGE 2 Skill)

SEQUENCE (where in the unit does this lesson best fit?):
Students should
1. have an understanding that objects have observable characteristics, and are made up of materials
2. be able to identify materials that make up objects
3. be able to consider the impact of material choice on people and the environment
4. be able to work in partners and small groups

TEACHING STRATEGIES:
Think-Pair-Share
Say and Switch
Stop and Jot
Placemat

SAFETY:
Use a large open area such as a gymnasium or school yard to introduce the frisbee activity. Teach students how to throw and catch the disc.

May require some additional teacher, parent or older student assistance and supervision for safety reasons when building and constructing.

BLACK LINE MASTER[S]:
TM-1: Say and Switch Description (Reference)
TM-2: Placemat Description (Reference)

TEXT REFERENCES:

Read-Aloud / Shared Reading:
"Let's Look at the Frisbee" by Angela Royston, Heinemann Library, ISBN-1-4034-7682-9

Guided / Independent Reading:

Additional Resources:
Beneficial to show pictures or drawings of unusual inventions to your students. Use the following link to see some very unusual real inventions.
http://www.eduplace.com/science/invention/resources/copy_masters/examples.html

Examples of Real Student Inventions
http://www.eduplace.com/science/invention/resources/real_inventions.html

Science & Technology Curriculum Expectations:
1.2 assess objects in their environment that are constructed for similar purposes in terms of the type of materials they are made from, the source of these materials, and what happens to these objects when they are worn out or no longer needed
2.1 follow established safety procedures during science and technology investigations
2.2 investigate characteristics of various objects and structures, using their senses
2.3 investigate, through experimentation, the properties of various materials
2.4 use technological problem-solving skills (see page 16), and knowledge acquired from previous investigations, to design, build, and test a structure for a specific purpose
2.5 use appropriate science and technology vocabulary, including *experiment, explore, purpose, rigid, flexible, solid,* and

smooth, in oral and written communication
3.5 identify the materials that make up objects and structures
3.7 describe the properties of materials that enable the objects and structures made from them to perform their intended function

Mathematics Curriculum Connections:

Language Curriculum Connections:

Say and Switch

(Grades K to 12)

(Cooperative Learning, page 204 Barrie Bennett - Carol Rolheiser - Laurie Stevahn)

Description

- a cooperative structure in which partners sequentially take turns responding to a question or discussion topic at signalled (and sometimes unpredictable) intervals.

Procedures

Step 1 Place students into partners.

Step 2 Identify the discussion topic.

Step 3 Identify the signal when roles will switch.

Step 4 Cue first partner to respond to question/topic.

Step 5 First partner shares while the second partner listens carefully.

Step 6 Use the signal to switch roles so the other partner shares while the first partner listens.

Step 7 Several switches may take place throughout the period of time allotted for discussion.

Prior Knowledge Required

- content for discussion
- active listening skills
- taking turns

Classroom Management Considerations

- remind students to use appropriate voice volume so others can hear their partner
- thought should be put into placement of partners around classroom
- thought should be put into who will work well as partners in this situation

Materials

- bell or some kind of noise-maker to signal the switch

Key Benefits	Effective Uses	Extensions / Modifications
• fosters oral communication skills and active listening skills • promotes student participation	• use as a structure for reviewing, rehearsing, or checking for understanding	• at the end of the session, have students summarize their partners' thoughts or their own thoughts orally with the class or in written form as a check for understanding • in Step 6 when the switch occurs, the challenge is for the second partner to complete or continue the first partner's line of thought before introducing new ideas

Teacher Notes and/or Reflections:

Placemat

(Beyond Monet, pages 172-173)

(Grades K to 12)

Description

- involves students working both alone and together around a single piece of paper with the goal of reaching consensus on the topic being investigated

Prior Knowledge Required

- social skills related to working on one piece of paper (e.g., working in own assigned space, respecting

Procedures

Step 1 Divide paper into equal sections based on the number of members in the group and put a square or circle in the centre of the paper.

Step 2 Each member writes his/her ideas in an assigned section of the placemat.

Step 3 The groups's central idea (consensus) is written in the centre circle or square after group members have shared their ideas.

Classroom Management Considerations

- desks arranged to allow students to be able to comfortably work on their section of paper

Materials

- paper (size depends on number of students in the group)
- teacher model of page set-up for students to copy OR photocopied page OR teacher-drawn sheets for each group

Placemat

Key Benefits	Effective Uses	Extensions / Modifications
• creates a visual display of learning • develops and fosters group work with each student accountable for his/her own work	• use after reading a story or poem (Have students reflect, write, draw, and share their ideas through a placemat approach.) • use to identify what students already know about a topic • use for problem-solving (Each student writes his/her solution in his/her section and then shares the solution with the group.) • use to come to a consensus on an issue • use to assign each student a question or key information to gather from a video, story, or reading	• use **Round Robin** tactic to share thinking within the group • weave a social or communication skill into the process (e.g., expressing ideas clearly, active listening, etc.) • use with **Concept Attainment;** As the data set is presented, students write in their hypothesis.

Teacher Notes and/or Reflections: