

S-O-I-L SOIL

Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 3:

Observe the basic components of soil and relate the components to plant growth.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Language Arts I-3 Listening and speaking
Language Arts VII-3 Different genres (tall tales)

Science
Standard
III
Objective
3

Connections

Background Information

Prior to teaching this lesson your students need to have basic knowledge of the components of soil.

You will also need to enlist a student or another teacher to help you with your invitation to learn.

At the end of this activity students should know these things:

- Plants need nutrients to grow.
- Plants get those nutrients from the soil
- Nutrients can be added to soil to help plants grow better.

Research Basis

Dickinson, V.L, Young, T.A. (1998) Elementary Science and language arts: Should we blur the boundaries? Retrieved 1/4/2007 from <http://www.education.ky.gov> Literacy and Science

Helping teachers see, understand, and implement instructional practices which rely on teachers' strengths in language arts instruction to improve their teaching of science content could be a solution to the lack of confidence in science instruction.

Nixon, D.T. Akerson, V. L. (2002) Building Bridges: Using Science as a Tool to Teach Reading and Writing Retrieved 1/4/2007 from <http://www.education.ky.gov> Literacy and Science

This study cited many previous studies that proved the value of integrating science and language arts. There are many reasons to consider the integration of science and language arts. The most compelling is evidence showing cognitive parallels. Reading, writing, and science all require a combination of cognitive processes and the

activation of conceptual knowledge. The strategies that are applicable to reading and writing are comparable with the strategies used to construct science understanding.

Invitation to Learn

Teacher dresses up as Old MacDonald. (Overalls, straw hat, shovel)
Comes in classroom carrying a small, wilted plant.

Old MacDonald: (Acting sad and discouraged) I am just not having any luck growing crops on my farm and I'm very worried about my farm and my animals! If I can't grow hay, my cow will get skinny and not give milk. If I can't grow corn there'll be no food for my chickens and they won't lay eggs and my pigs won't grow big and fat and there'll be no bacon to eat for breakfast! Even my poor old horse will get too tired to take me for a ride if I can't grow oats. Something is wrong with my farm, but I just don't know how to fix it—I must be a bad farmer!

Student or another teacher dressed as a scientist in a lab coat enters the room carrying a bucket of soil.

Scientist: " Old MacDonald I think I know what your problem is..... you're not a bad farmer...it's your soil!"

Old MacDonald: My soil? (Looks in bucket) That's just plain old dirt! What's dirt got to do with not being able to grow crops for my animals to eat?

Scientist: What's dirt got to do with it? Just everything Old MacDonald!

(In an aside whisper to students: "Maybe he is a bad farmer if he doesn't even know that—lucky we came along to help him!")

Lucky for you, I'm a soil scientist and I've got all these great assistant scientists to help you out. We'll dig (ha-ha) until we find out what the problem with your farm is, don't you worry! And to cheer you up and help you understand what soil has to do with your crops we'll sing you a song! Okay, assistants you know this song...help me sing it so we can get started on helping Old MacDonald fix this farm.

Song (To the tune of Old MacDonald Had a Farm)

Old MacDonald had a farm

S-O-I-L SOIL

And on his farm he had some crops

S-O-I-L SOIL

With some shriveled corn here and a skinny cow there

Here no crops, there no crops

Your soil's why there's no crops

Old MacDonald had a farm

S-O-I-L SOIL

Scientist: Are you ready assistants? We're going to fix this soil and help Old MacDonald have the best farm in Utah!

Old MacDonald: Yippee! Let's get going!

Instructional Procedures

1. Make Soil Journals (It would be best to have these made ahead of time)
2. Access students' prior knowledge about what plants need to grow. Draw a plant on the board or on a poster showing what plants need. Patterns for students to trace to make their flowers are included in Soil Journal blacklines. Have students copy this information onto the flower. Each section goes on a different petal. When done they can insert the flower into the cover of their Soil Journal.

Plants need:

Sunlight: They need to be planted where they can get the amount of sunlight they need. Some plants like shade and some like full sun.

Water: Plants get water through their roots. If they have too much or too little water they will not grow well.

Air: Soil needs to be loose and have air pockets in it for the plants. If the soil is too wet or too tightly packed there is not enough air.

Nutrients: Plants need certain foods called nutrients to grow and be healthy just like you do. These nutrients come mainly from decaying organic (plant and animal) materials in the soil.

3. Ask this question: What does soil have to do with plant growth? Listen to this excerpt from a tall tale about a farmer named McBroom who bought a wonderful one-acre farm. See if you can figure out what the soil on his farm had to do with the way his crops grew.

Read this excerpt from *McBroom Tells the Truth* by Sid Fleischman

Materials

- Farmer costume
- Scientist lab coat
- Bucket of soil
- Old MacDonald song overhead
- Soil journals
- Sample of fertile soil, organic rich
- Sample of infertile soil, poor nutrients
- Small wilted plant
- White butcher paper
- Magnifying glasses
- Crayons / colored pencils
- 12 x 18 white art paper
- Fine point markers
- Old MacDonald's Script*
- SOIL



But the moment I ran the topsoil through my fingers, my farmer's heart skipped a beat. That pond bottom felt as soft and rich as black silk. "My dear Melissa!" I called. "Come look! This topsoil is so rich it ought to be kept in a bank."

I was in a sudden fever of excitement. That glorious topsoil seemed to cry out for seed. My dear Melissa had a sack of dried beans along, and I sent Will and Chester to fetch it. I saw no need to bother plowing the field. I directed Polly to draw a straight furrow with a stick and Tim to follow her, poking holes in the ground. Then I came along. I dropped a bean in each hole and stamped on it with my heel.

Well, I had hardly gone a couple of yards when something green and leafy tangled my foot. I looked behind me. There was a beanstalk traveling along in a hurry and looking for a pole to climb on.

"Glory be!" I exclaimed. That soil was rich! The stalks were spreading out all over. I had to rush along to keep ahead of them.

By the time I got to the end of the furrow the first stalks had blossomed, and the pods had formed, and they were ready for picking.

You can imagine our excitement. Will's ears wiggled. Jill's eye's crossed. Chester's nose twitched. Hester's arms flapped. Peter's missing front teeth whistled. And Tom stood on his head.

"Willjillhesterchesterpeterpollytimtommarylarryand littleclarinda," I shouted. "Harvest them beans!"

Within an hour we had planted and harvested that entire crop of beans. But it was hot working in the sun! I sent Larry to find a good acorn along the road. We planted it, but it didn't grow near as fast as I had expected. We had to wait an entire three hours for a shade tree.

Of course, there was a secret to that topsoil. A government man came out and made study of the matter. He said there had once been a huge lake in that part of Iowa. It had taken thousands of years to shrink up to our pond, as you can imagine. The lake fish must have been packed in worse than sardines. There's nothing like fish to put nitrogen in the soil. That's a scientific fact. Nitrogen makes things grow to beat all.

4. Tell the class: This story gave us some good clues about what needs to be in soil for plants to grow. We are going to study two soil samples. One sample is rich, fertile soil...this would be the kind of soil on McBroom's farm where the crops grew very well. The other will be poor, infertile soil, like the kind on Old MacDonald's farm where the crops are not growing well at all.

Discuss the adjectives "rich" and "poor" used to describe soil—why do you think these are good descriptions of soil?

Our job will be to examine these soil samples and figure out what the difference is between rich fertile soil and poor infertile soil

5. Put class into groups. Have them put their desks into tables and then cover the desks with white butcher paper or large white art paper. Give each group two soil samples—label the Fertile Soil “McBroom’s Farm” and the infertile soil “Old MacDonald’s farm. They will need their crayons or colored pencils and their Soil Journals.
6. Instruct students to carefully spread out their two soil samples—making sure not to mix the two samples. Closely examine and compare the two soils, use the magnifying glasses. Look at the color and the composition of the soil. Does it look like there would be air in the soil? How much water is in the soil? What texture is the soil?

Separate the living and once-living organic materials from the non-living inorganic materials.

You could have students draw a graphic organizer such as a word web to help them organize the different components.

7. In their Soil Journals they need to do a Compare/Contrast rectangular Venn diagram.

McBroom’s Rich Fertile Soil Things that are Different	Things that are alike about the two soils	Old MacDonald’s Poor Infertile Soil Things that are Different

They need to look for things that are similar between the soils and things that are different. Use words and pictures to complete the diagram.

8. Each group needs to come up with a hypothesis about what differences in the soil affected the plant growth. They need to use words like fertile, infertile, nutrients, and organic in their hypothesis. Have each group choose a scribe or secretary to write down their ideas. Give them a large 12 x 18 paper and

markers to write with so the others can see it to copy it into their journals after the groups are satisfied that they have correct final version of their hypotheses.

Example: The fertile soil from McBroom's farm had lots of organic material in it. There were decaying plants and even a worm. We think the organic matter provided the nutrients that the plants needed to grow better. The soil had enough air in it for the plants to live and the right amount of water.

The infertile soil from Old MacDonald's farm was very (sandy, dry, loose) or (heavy, wet, sticky, hard) so it did not have the right amounts of air and water. There was hardly any organic matter in it, so there weren't enough nutrients for the plants to grow.

9. On the next page in their journals they need to illustrate the two farms, showing the type of soil and the way plants would grow. Label the first drawing "McBroom's Fertile Farm". Label the second drawing Old MacDonald's Infertile Farm.

10. Discuss with class:

Can we help Old MacDonald with his problem?

Can he improve the soil on his farm so his crops will grow better?

What are some things you think would help?

11. Tell class that you have a Readers' Theater that will help them learn about things they can do to help improve soil so it can grow crops better. When you finish the Reader's Theater have a class discussion and talk about what they learned about soil from doing the play.

Assessment Suggestions

- Formative: Teacher observation as they come up with hypotheses about soil.
- Evaluation of their journal pages
- Final Assessment: S-O-I-L Soil (Blackline in appendix)
- Read situation cards with multiple-choice answers to class. Have them write their answers on an answer sheet.
- Example:

The flowers in Bob's garden are dying. The roots and stems are all waterlogged. What does he need to do?

A. Mix more clay in with the soil

- B. Mix more sand in with the soil
- C. Water the flowers more
- D. Add fertilizer

Curriculum Extensions/Adaptations/ Integrations

- Struggling readers: Give them a copy of the Reader's Theater in advance and have them practice their parts.
- Have students make props and figure out actions/movements to add to Reader's Theater
- Ask students to get a soil sample from their yards and bring to school to analyze
- Invite an expert gardener to come to your class and talk about what they do with their soil
- Go on a mini field trip to visit a neighborhood garden or farm.

Family Connections

Encourage students to discuss plans with their families to allow child to have a small garden plot or flower garden. Have student teach family what they can do to make the soil fertile.

Additional Resources

McBroom Tells the Truth, by Sid Fleischman; ISBN 0843179437 (available at amazon.com)

McBroom's Wonderful One Acre Farm, by Sid Fleischman; ISBN 0688155952

Readers' Theater

"Old MacDonald's Soil"

Characters: Adjust the number of characters for each part so each child in the class has a part
Old MacDonald
Farm Animals
Soil Scientists
Crops
Worms

Old: (*Surveying his crops*) Oh dear...My farm is just not doing well. The crops are not growing. What am I going to do?

Crops:

Corn: (*Falling over*) We just can't stand up in this sandy soil Old MacDonald! And we're dying of thirst. As soon as you give us water it runs right through the soil so fast that our roots can't even catch any of it to give us a drink! You need to do something fast!

Hay: (*Acting like they're swimming*) Well what about us Old MacDonald? We're drowning over here.... you planted us in the heavy clay soil. The water just puddles up so we can't get enough air because our roots are always soaking in water. Then when the water finally starts to dry up this soil is like cement. Would you like to have your feet stuck in cement?

Vegetables: (*Acting weak and sickly*) You think you guys got it rough? You should be us! Old MacDonald expects us to grow big healthy vegetables to feed his animals and his family...but we're not getting anything to eat ourselves! There are no nutrients in this soil. How's a vegetable supposed to grow up to be healthy if we don't get any nutrients? You need to go to farmer school Old MacDonald!

Animals:

Horse: If you think I'm gonna pull your wagon, or take you for a ride, you better get me some food. I'm too weak to even lift my hooves. I need food now!

Cow: Milk? You got milk? I don't got milk! I need some good food if I'm gonna make milk. Get busy old MacDonald!

Pig: Pigs are supposed to be fat Old MacDonald! I'm ashamed to show my face... and my skinny belly. A skinny pig...that's a disgrace old MacDonald. We want food!

Chicken: (*Scratching through dirt*) Corn? Where's the corn? I've scratched until my poor feet are worn clear down to the chicken bone! How's a chicken supposed to survive if there's not any corn to scratch and peck! No eggs for you Old MacDonald!

Soil Scientists: (*Driving by in bus*) What's going on at that farm? The animals and the crops are all yelling at the farmer. We better stop and help him out before he has a war on his hands!

- Scientist #1:** What's the problem here?
- Old:** I don't know what's wrong. I just can't get my crops to grow, so I don't have any food for my animals! They said I need to go to farmer school...but I don't know where a school like that is.
- Scientist #2:** Well I'd say you are in luck Old MacDonald. You don't need to go to a farmer school.... we can bring the school to you!
- Scientist #3:** *Yup...*that's what we do! We're Soil Scientists and we travel around helping farmers grow better crops.
- Scientist #4:** Let's take a look scientists, and see if we can figure out what the problem is.
- All scientists:** (*Look carefully at the crops.... say things like "I see" "oh dear, this is a problem, no wonder, etc.)*)
- #1:** Old MacDonald, your problem is your soil. You need to fix your soil before your crops can grow and you can feed your animals.
- Old:** Fix my soil? How on earth do you do that?
- #2:** Well you have a lot of problems on this farm so we better tackle them one at a time.
- Crops:** (*all together*) Me first.... we're the worst...take care of me now...I'm dying...you better get over here fast!
- Animals:** (*All pointing to or gathering around their favorite crop*) Yeah, come on scientists, take care of this one...I'm sure this is the most important...I'm starving, etc.
- #3:** Hold your horses! (*All the animals grab onto the horse*) Not like that...I mean just hold on a minute. We'll take care of everyone.... don't worry!
- #4:** Let's start with this corn. It's falling over and it looks like it really needs a drink!
- Corn:** Oh thank you thank you.... you're right. We can't last another minute!
- #1:** The problem, Old MacDonald, is you planted your corn in sandy soil. Sandy soil is too loose to hold up big plants like corn.
- #2:** And the water runs right through it. Your soil is all dried out before the corn gets any water!
- Old:** Well what can I do.... I had to plant it somewhere. Who knew corn was so picky?
- #3:** Well first thing old MacDonald is you need to mix some clay into this soil. That will make the soil stronger and it will slow down the water. Then your plants will get the water they need.
- #4:** Good soil is a mixture of the different types of soil.
- Hay:** Don't forget us!
- Horse:** Yeah, don't forget them...it's way past my lunchtime!
- #1:** Well the problem with this soil is it's straight clay. You need to mix some sand into the clay. That will make the soil lighter.
- #2:** Your plants will be able to get the air they need because they won't be waterlogged all the time.
- #3:** There's part of your solution Old MacDonald...just mix up these two soils. They'll both be better if you mix them together. Good soils are a combination of sand, silt, and clay.
- Vegetables:** Okay, but we are growing in average soil. It's really not too heavy or not too light...but we're starving. There's nothing to eat in this soil.

- #4:** You need to mix in some nutrients in all your soil Old MacDonald. Plants need to eat too.
- Old:** Plants need to eat? That's news to me. What did you say they eat?
- #1:** Nutrients
- Old:** Well what are they and where do you get them? Can I go to a drive-thru?
- #2:** It's the things in the soil that plants need to grow and make their own food.
- #3:** You have plenty of them right here on your farm.
- #4:** Yes, Some nice manure from your cows, or some dead leaves and plants will help add some nutrients in the soil for your plants.
- #1:** You just throw them on the soil and dig them in. they break down in the soil and the plants can get the nutrients they need. That's called organic matter and it's really important that there is plenty of organic matter in soil.
- Old:** Well that doesn't sound too hard...is there anything else I can do?
- #2:** You could go the Farm store and buy fertilizer.
- #3:** Yes, some companies make fertilizer that you can use in your soil. It contains the nutrients that plants need to grow healthy and strong.
- #4:** It's called fertilizer because it helps the soil become fertile. Fertile means it can grow really good crops and plants.
- Worms:** (*Lying on the floor*) Hey, don't forget about us!
- Old MacDonald:** Worms? I'm not going fishing. (*Worms shudder and look scared*) I need to fix my soil. What do worms have to do with that?
- Worms:** (*Pop up from floor*) We'll tell you that ourselves!
- Worms sing:** (*Tune: Mary Had a Little Lamb*)
Worms do lots of good for soil, good for soil, good for soil
We dig and loosen up the soil and that makes room for air
Our castings fertilize the soil; make fertile soil, fertile soil
We add nutrients to the soil and that helps plants to grow.
- Old:** Wow! You really do help the soil...I won't use you for bait anymore!
- Worms:** (*Look relieved and cheer*)
- Scientists:**
- #1:** So that's the bottom line Old MacDonald. You want good crops and food for your animals you better have good food for your plants...
- #2:** and that means good soil...
- #3:** Not too light and loose and dry...
- #4:** Not too heavy and packed and wet...
- All:** And plenty of nutrients.
- Old:** I think I've got it. I need to go mix my soils...a good combination of sand, clay and silt is what plants need.
- Crops:** And don't forget the nutrients!
- Animals:** Yep, add organic matter and fertilizer.
- Worms:** And remember we can help!
- Old:** Yippee! I think I'm gonna have the best soil in the state!
- Crops:** And the best crops!
- Animals:** And the best fed animals!
- All:** The best farm!

All characters sing: Old MacDonald had a farm S-O-I-L SOIL
And on his farm was fertile soil S-O-I-L SOIL
With great soil here and nutrients there
Here great crops, there great crops
The soil's growing great crops
Old MacDonald had the best farm S-O-I-L SOIL

Final Assessment S-O-I-L Soil

<p>The flowers in Bob's garden are dying. The roots and stems are all waterlogged. What does he need to do?</p> <p>A) Mix more clay in with the soil B) Mix more sand in with the soil C) Water the flowers more D) Add fertilizer</p>	<p>Sally is trying to grow large sunflowers in her garden, but they keep falling over. They keep wilting because they aren't getting enough water. What should she do?</p> <p>A) Mix more clay in with the soil B) Mix more sand in with the soil C) Water the flowers more D) Add fertilizer</p>	<p>Tom's crops did not grow well this summer because there was very little organic matter in the soil. It is now autumn. What could Tom use to add organic material to his soil?</p> <p>A) Water the garden a whole bunch before winter B) Plow or till up the soil to add air C) Put the leaves that he rakes into the garden. Let them decay and then dig what's left into the soil in the spring.</p>
<p>Sarah's soil is very tightly packed. It has a lot of clay in it. The plants' roots have a hard time getting down into the soil. What could she do?</p> <p>A) Get some sandy soil and till it into garden's soil. B) Nothing, she will just have to give up gardening C) She will have to go to the store and buy all new soil</p>	<p>Paul has been growing hay in the same field for 10 years. This year the hay did not grow very well. What could he do?</p> <p>A) Sell the field B) Water the field more C) Plant a different crop that uses different nutrients than hay and add some fertilizer.</p>	<p>Susan needs to add nutrients to her soil. Which of these things can she not use?</p> <p>A) Manure from a neighbor's farm. B) Rocks from the field across the street C) Fertilizer she can buy at the store</p>
<p>Farmer John says his soil is fertile. What does he mean?</p> <p>A) His soil is full of tile. B) His soil grows plants well. C) His soil is sand.</p>	<p>Organic means:</p> <p>A) Living and once-living things B) Non-living things such as water, air, and rocks</p>	<p>Tiffany's garden has poor, infertile soil. Her garden will probably:</p> <p>A) Produce lots of strong, healthy plants. B) Produce a few unhealthy plants.</p>