

Teacher's Preparatory Guide

Bringing the Macro to the Nano in the Early Elementary School Classroom Lesson 3

Big vs. Little – Micro to Nano

Overarching Question or Statement: Using different eyes

Purpose: Through guided discovery, children will understand that there is another, more precise, level of observation; the nanoscale.

Time required: 45 minute session for lesson, extension activities require additional time

Level: Early Elementary, grades 1-3

Materials

For Lesson

- Butterfly images (1 at macro scale, 1 at micro scale, and 1 at nano scale)
- Picture of earth as viewed from space
- Marble
- Meter stick
- (1) 4" by 11" strip of paper
- Scissors
- Student Science journals

Advance Preparation:

Print off images from Internet and gather materials

Teacher Background:

Important Vocabulary

- Nanoscale – Things that are very, very small; too small to see with a standard microscope
- S.E.M. (Scanning Electron Microscope) – This is a sophisticated microscope that enables scientists to view objects at the nano level. They are used at universities and research facilities. Some of the images of the butterfly wing was taken using an S.E.M.

Teaching Strategy: See, Think, & Wonder

National Nanotechnology Infrastructure Network

www.nnin.org

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This strategy can be used to have children tell you what they see, think, and wonder about something. First, children observe an object or image and tell you what they see. Next, they think about the object or image and share what they are thinking. Lastly, based on what students have shared about what they see and think, encourage higher level thinking by asking them to tell you what they wonder about the object or image.

Teaching Strategies: whole group and partner work
(see above for description of See, Think, and Wonder strategy)

Resources:

A good website for additional information and activities for children: www.nanozone.org

Free images of butterflies can be located at <http://www.butterflypictures.net/>

Images of butterflies under microscopes can be located at
<http://micro.magnet.fsu.edu/optics/olympusmicd/galleries/butterfly/index.html>

Image of earth from space can be located at
http://ay.wikipedia.org/wiki/Archivo:Earth_from_Space.jpg

Instructional Procedure:

Introduction: (approx. 5min.)

Gather children in a group, on the floor, with their science journals. Invite a few children to share their drawings and descriptions from the previous lesson.

Part One: (approx. 10 min.)

Introduce the S.E.M. image of the butterfly wing to the children. Have the students use the see, think, & wonder strategy with a partner. Allow the pairs 5 minutes to share their ideas with each other. Then, gather as a group and ask children to share what they see, think, and wonder about the image. At the conclusion of student sharing, the teacher will identify the image by showing the students a macro image of a butterfly.

Part Two: (approx. 20 min.)

Through guided discovery, the teacher will now lead a discussion about the difference in scale using the 3 butterfly images. Show the picture of a butterfly and review macro. Next, show the picture of the butterfly wing and review micro. Then, show the picture of the butterfly scales and introduce the term nano. Tell students that this picture was taken at the nano scale. Ask students if they have ever heard this term used before. (Some students may say they have heard it because of the I Pod Nano or the word nanosecond, which is a great connection.) Explain to the children that a nanometer is a term used to measure very, very small objects, ones that are too small to see even with a standard microscope. It is one billionth of a meter.

Here are a few quick activities and examples to illustrate just how small a nanometer is.

- Show students a meter stick and remind them how we use it to measure every day objects. Next, take out the 4" by 11" strip of paper and the scissors. Begin cutting the paper in half. Keep cutting each half again until you have a piece that is as small as a human hair. Tell students that we would need to continue cutting it about 50,000 more times to show a nanometer. Explain that it would be too small to see with just our eyes.
- Show students a picture of the earth taken from space and tell students that if they were looking at earth from space like this, then a nanometer is like the size of a marble (hold up a marble). Tell them, "So if you were in space and looking for a marble in your backyard, the marble would be the size of a nanometer." Ask, "Would you be able to see the marble from space?" Reinforce that it would be too small to see with just our eyes.
- Interesting fact – A nanometer is how far your fingernail grows in one second. Have students look at one of their fingernails. Tell them to count 1 second. Ask, "Did anyone notice a change?" Students should say they didn't notice anything and, at this point, you can tell them that a fingernail grows 1 nanometer per second. Ask, "Were we able to see this? (no) Why not? (because a nanometer is too small to see with just our eyes)"
- Interesting fact – There are more nanometers in the length of your hand than cars in the United States. See Extension section below to view corresponding activity.

Conclusion: (approx. 10 min.)

Review presented information including the terms, nano, nanometer, nanoscale, microscale, and macroscale. Remember that nano means one billionth of something so one nanometer is one billionth of a meter, which is very, very small. Remind students that when looking at things that are at the nano scale, we are looking at things that are ultra small and can not be seen with our eyes or a regular microscope.

Have children work with a partner to share what they have learned about the nanoscale. Then, ask children to independently record their understandings of the nanoscale in their science journals, using pictures and/or words. These will be shared at the beginning of the next lesson.

Extension: (approx. 20 min.)

Center activities

- 1) Computer – Have students explore the website www.nanozone.org where they can play games and learn more information about the nanoscale
- 2) Hand activity – To illustrate the analogy of the cars and length of hand, have students trace one of their hands in their science journal. Then have them draw and count the number of dots that can fit between their wrist and tip of their longest finger. Record the number on the lines provided. These can be shared during the next lesson.

National Science Education Standards

National Science Education Standards K-4

- Content Standard A Science as Inquiry
 - Abilities necessary to do scientific inquiry
 - Understanding about scientific inquiry
- Content Standard B Physical Science
 - Properties of objects and materials