Microbial Discovery Activity

One of These Things is Not Like the Other

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Intended Audience

K-4
5-8   X
9-12   X

(*This lesson is most appropriate for students in grades 5-8. However, it may also be slightly adapted to allow younger students to complete the activity.)

Activity Characteristics

Classroom setting     X
Uses hands-on manipulatives   X
Requires group work     X
Introduction

Description
Observation of different kinds of materials for microscopic similarities and differences.

Abstract
Using a 50X microviewer, participants will observe textiles and other materials for microscopic similarities and differences. They will construct a game board in which "one is not like the other" and then challenge another participant to decipher the unlike material.

Core Themes Addressed

<table>
<thead>
<tr>
<th>General Microscopy Concepts</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbial Cell Biology</td>
<td></td>
</tr>
<tr>
<td>Microbial Genetics</td>
<td></td>
</tr>
<tr>
<td>Microorganisms and Humans</td>
<td></td>
</tr>
<tr>
<td>Microorganisms and the Environment</td>
<td></td>
</tr>
<tr>
<td>Microbial Evolution and Diversity</td>
<td></td>
</tr>
<tr>
<td>Other -Common properties of life; Cellular components</td>
<td></td>
</tr>
</tbody>
</table>

Keywords
Microscopic, Microviewer, Classification, Taxonomy.

Learning Objectives

By completing this activity, the student will be able to:

- Demonstrate the use of the microviewer
- Recognize microscopic similarities between materials
- Compare and contrast microscopic characteristics of materials
- Create a classification scheme of like and unlike materials
- Support their critical thinking and organization of their classification system.
- Gain an appreciation for the Science of Taxonomy
- Identify reasons why it is important to classify organisms
National Science Education Standards Addressed

All Levels of Learning:

1. Unifying concepts:
   Systems, order and organization
   Evidence, models and explanations
   Change, consistency and measurement
   Form and function

2. Science as Inquiry:
   Abilities necessary to do scientific inquiry
   Understanding about scientific inquiry
Student Prior Knowledge
None required.

Teacher Background Information
"You see, but you do not observe." Sherlock Holmes to Dr. Watson in A Scandal in Bohemia

Humans have always been prompted to record observations. Long before our ancestors developed writing, they created art representing their observations. Samples of paleolithic art dating back over 40,000 years indicate that early peoples made careful observation and study of their surroundings. The earliest cave paintings portray scientific reality, for these were didactic images, not merely decorative additions. Science has been characterized as being based upon observation and experiment, guided by reason. Observation in science is more than just seeing; it refers to skills associated with collecting data using all the senses, as well as instruments that extend beyond the reach of our senses. Observations are influenced by the assumptions and theoretical knowledge of the observer. Until recently, classification of living organisms has been based upon observable characteristics. Today, some classifications have been challenged because more sophisticated methods can be applied. However, the art of observation should be taught and practiced in the classroom.

In this activity, students will apply problem-solving skills to observations using a tool that will extend beyond the reach of vision - the microviewer.

Class Time
1 hour.

Teacher Preparation Time
This lesson will require approximately 15 minutes of preparation time.

Photocopy the supplied game board or draw lines on pieces of poster board to create a grid following the supplied pattern. Additional or fewer squares can be used based upon the time you intend to devote to this activity.
Materials and Equipment

2-4 microviewers
samples of fabric
paper
powders (salt, sugar, flour, etc.)
pages from magazines
pieces of newspapers
scissors
glue stick
tape
one game board
Microviewers 60-100x can be purchased from Radio Shack, cat # 63-1133. For more information visit <www.RadioShack.com>.

Using the microviewer (excerpts from user's manual)
The 60-100X compact size microscope lets you see objects in great detail. Its built-in mini-bulb concentrates light directly on the object you want to view.

1. Place the object you want to view on a flat surface. Note: Items will appear inverted when viewed through the eyepiece.
2. Turn on the light by setting the ON/OFF switch to the ON position.
3. Rotate the ZOOM knob to select the magnification power (from 60 to 100 times).
4. Look through the eye piece and rotate the FOCUS knob for the sharpest image you can see.
5. Caution: Use only fresh batteries of the required size (2 AAA). Do not mix old and new batteries, or mix different types of batteries (standard, alkaline, or rechargeable). Instruct students to dispose of old batteries promptly and properly.
Methods
Cut newspaper, magazines, or pieces of fabric into smaller squares to facilitate sharing among the groups. Prepare game boards using the template included in this exercise.

Delivery
1. If necessary, instruct the students in the use of the microviewer. Newspaper comics are ideal for this. Have the students note the limitations of the microviewer (distance from the object, amount of light to see clearly, etc.).
2. Explain to the students that they will be creating a puzzle for another group to decipher by looking at the materials and observing differences and similarities in microscopic appearance. Stress that the observations are to be made microscopically.
3. The following questions can be given to the students on a worksheet, or written on the board:
   A. What characteristic(s) did the materials that you observed have in common?
   B. What are some major differences among the materials you observed?
   C. Explain why you chose the item that "is not like the other."
4. Once completed, students should be encouraged to share their answers.

Safety Issues
- Students should exercise care when using scissors. Instruct them to point them away from the body when cutting.
- Remind students not to point scissors at other individuals.

Suggestions for Assessment
- Presentation (verbal or computer –based)
- Create a concept map that describes the activity and its results.
- Group discussion
- Use a rubric to assess any of the suggestions above.- See the Supplementary Materials section for several sites on rubrics.

Tips/Suggestions
- Have the fabric cut into smaller squares prior to the activity so that the pieces are more easily shared.
- Provide a game board for each group of students.
- Prepare extra game boards for students who glue materials onto the board prematurely.
- Expect some frustration as students try to match both horizontally and vertically. While this activity appears to be simplistic, you will be deceived.
Supplementary Materials

Modifications or Extensions

1. For higher grade levels, make the classification activity more challenging by increasing the number of squares.
2. Use the fabric to create a dichotomous key and have the students key out fabric samples.
3. Take the students to a field trip with their microviewers and let them gather and choose items for their game board.

Links to obtain addition information:

Introducing Classification
http://www.usoe.k12.ut.us/curr/science/sciber00/7th/classify/sciber/intro.htm

NCBI Taxonomy Browser

The Nuts and Bolts of Taxonomy and Classification
http://jrscience.wcp.muohio.edu/lab/TaxonomyLab.html

The Tree of Life Web Project
http://tolweb.org/tree/phylogeny.html

References

Thanks to Drs. Ken Anderson and Douglas Zook for ideas for this activity.

Resource Category: Pre-college

Pattern for Game Board is included on the following page. This pattern can be photocopied or recreated on sturdier paper. Additional squares can be added.
Completed game board and microviewer
Procedure for Participants

Using the microviewer (excerpts from user's manual)

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1. Place the object you want to view on a flat surface. Note: Items will appear inverted when viewed through the eyepiece.

2. Turn on the light by setting the ON/OFF switch to the ON position.

3. Rotate the ZOOM knob to select the magnification power (from 60 to 100 times).

4. Look through the eye piece and rotate the FOCUS knob for the sharpest image you can see.

5. **Caution**: Use only fresh batteries of the required size (2 AAA). Do not mix old and new batteries, or mix different types of batteries (standard, alkaline, or rechargeable). Instruct students to dispose of old batteries promptly and properly.
Instructions for Activity

1. Begin by observing a number of materials with the micro viewer.
2. Group them into categories such as weaves, prints, metallic threads, etc. "Powders" such as salt, pepper, and sugar can also be used.
3. Cut small pieces of the materials and place them on the game board so that in the first horizontal row two of the observed patterns or characteristics are the same and one is different.
4. Do not glue the material on to the card until you are finished with all of the rows.
5. Repeat the procedure for the second and third horizontal rows. For an additional challenge, see if you can match patterns or characteristics vertically as well as horizontally.
6. When you have completed your game board, glue the material onto the board and share it with another group, challenging them to find "which of these things is not like the other?"