Student Lab: All About Microscopes (3-8)

Program Summary

In this laboratory activity, students are introduced to two key tools of science: the compound microscope and stereo microscope. After discussing basic parts and uses, students are given ample time to practice using both pieces of equipment. Students will investigate slide-mounted and pinned insect specimens, drawing and recording observations at successively higher magnifications. By the end of the lesson, each student has played the role of one of our researchers in the field: when one comes across an unknown organism, he or she must learn to make careful observations and effectively communicate these findings to others.

The program begins with an introductory brainstorm on why scientists use microscopes, how they work, and why they are interesting. The instructor introduces the concept of magnification.

Guided by the instructor, the students point out immediately discernible differences between the two kinds of scopes in the room. For example, compound microscopes have one eyepiece, more than one objective lens, and are used to study thin slices of a specimen mounted on a glass slide; stereo microscopes have two eyepieces, appear to have only one objective (but actually have two), and are used to study whole specimens. The names and functions of the microscope parts involved are reviewed as a group, using grade-appropriate vocabulary.

The instructor then prepares the students for their own personal microscope investigation by leading the class through a live demonstration with a digital scope. The students are asked to use descriptive terms to share what they see projected on the screen, and are subsequently challenged to make ever more precise and objective descriptions, both quantitative and qualitative. This demonstration also serves to model the concept of focusing an image, empowering students to make adjustments on their own during the exploratory period.

The students now make their own investigations, recording findings on a worksheet. Each student spends several minutes drawing sketches and writing descriptions of an insect specimen using a microscope under successively greater magnification. The aim is to describe the specimen in sufficient detail to successfully convey to someone who has never before encountered the specimen what it looks like. Emphasis is placed on scientific drawing, and on detailed notes, such as the counting of parts, and the noting of colors, shapes, apparent textures, and details not visible with the naked eye. Students are encouraged to jot down questions they may have about their specimen. Half the class uses compound microscopes, while the other uses stereo microscopes. Then they switch. Each student views two unique specimens, which personalizes the experience.

Returning together as a group, students are encouraged to share their work with the class, or share something they saw with the aid of the microscope that surprised them (for example, hairs that aren't visible with the naked eye, or colors they didn't expect to find on an insect).

To conclude, the class fills out a simple table comparing the differences between the two scopes, based on their experience using both tools. Time permitting, a closer look is taken at further aspects of contrast: orientation of the light source, the degree of magnification, and the practical applications best suited for each microscope. Regardless, the class is sure to work through the concept of magnification with a modeled example, inspiring awe in the power of these instruments!

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Grade 3

SCIENCE PS 2d; I&E 5b, 5c

Physical Sciences

2d. Students know an object is seen when light traveling from the object enters the eye.

Investigation and Experimentation

5b. Differentiate evidence from opinion and know that scientists do not rely on claims or conclusions unless they are backed by observations that can be confirmed.

5c. Use numerical data in describing and comparing objects, events, and measurements.

Grade 4

SCIENCE I&E 6a

Investigation and Experimentation

6a. Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.

Grade 5

SCIENCE I&E 6f, 6g

Investigation and Experimentation

6f. Select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.

g. Record data by using appropriate graphic representations (including charts, graphs, and labeled diagrams) and make inferences based on those data.

Grade 6

SCIENCE I&E 7b

Investigation and Experimentation

7b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.

Grade 7

SCIENCE LS 6b, 6d; I&E 7a

Life Sciences

6b. Students know that for an object to be seen, light emitted by or scattered from it must be detected by the eye.

d. Students know how simple lenses are used in a magnifying glass, the eye, a camera, a telescope, and a microscope.

Investigation and Experimentation

7a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.