Instilling Inquiry with Microscopes

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Biology teachers know that the microscope is a basic piece of equipment. Students are thrilled to use the microscope, but few actually understand the science that developed the microscope. In the past, I have, as many other biology teachers do, introduce the microscope by sharing some of its history through a power point presentation or video. My students and I would discuss individuals that developed the microscope. However, we ignored the process of science in the history. Upon reflection I found that the microscope was actually a fantastic opportunity for my students to begin learning inquiry in science. I have used this activity in both high school and college level classes.

Materials Required:

Newsprint
clear plastic *(I use discarded lamination edging.)*
water
Erlenmeyer flask, Florence flask, collection jar (any clear containers)
pipette
magnifying lenses
construction paper
tape
binocular dissection microscope
compound light microscope
scissors
lab notebook

Engage:

Students work in pairs to allow discussion of any phenomena noticed. Each pair is given a small sample of newsprint, a clear plastic square, container of water, and a pipette. Students lay the plastic on top of the newsprint and drop 1 drop of water on the plastic. In their lab notebooks students draw the water bubble that forms and describe any difference from the original. Students observe the print from different angles by moving around the water drop (and not moving the water drop itself). Students are allowed to add more drops of water and note any differences, through drawing and written notes. I ask the students if the print always appears the same at different angles. As a class we discuss what it is about water that allows this phenomenon to occur.

Explore:

Each pair is give an Erlenmeyer flask, Florence flask, collection jars, or any clear container, all containing water. Again students use the newsprint as a specimen to observe through each container, noting differences in the specimen as they make observations (including drawings) in their notebooks. I pose the question, “Does the shape of the container affect the path of light through water?” As students provide answers I list their responses on a large piece of paper or on the board. Students begin to realize

that the shape does impact the path of light and that the shape also affects magnification. Students determine the best shape for magnification.

At this point the glass containers are collected and magnifying lenses (2 per group) are distributed. I introduce the concept of glass lenses by using magnifying lenses. Students explore the effect of increasing and decreasing the distance between specimen and lens and record observations in their lab notebook.

Next, students stack the magnifying lenses to see the impact. Students will create distance between the two lenses and make written and drawn observations of their explorations.

Explain:

At this point I introduce the two types of microscopes available for our use: the binocular dissection scope and the compound light microscope. I ask students to identify which is more closely related to using a magnifying lens. We discuss the differences between the two types of scopes and determine which would best used to observe the surface of small specimens. Students identify that both can be used, but the binocular dissection scope is more like the magnifying lens as it increases the image size of the specimen and allows the viewer to see the surface more clearly.

Most students will have had some experience with using a compound light microscope but that experience is usually limited to viewing prepared slides. Students can identify why the specimen on the slide needs be thin (to allow passage of light in order to see details). They do not understand the internal structure of the microscope or how it is worked to focus images.

Elaborate:

Together the students and I draw an image of a compound light microscope, they in their notebooks and I on my board. We label the parts of the microscope and discuss the purpose of putting the magnifying lenses in a tube. Students explain their ideas and design a body tube out of construction paper. Their body tube must support a magnifying lens at the bottom and allow them to adjust the second magnifying lens in order to focus the image. Scissors and tape are available for student use. Students draw their design into their lab notebook and make written observations of how the image changes as they hold the adjustable lens at three different positions. Students note that the image size changes in size and position. As a class we discuss the path of light through the lenses and how the image changes due to refraction of light.

Evaluate:

Student pairs present their design to the class. As a class, the designs are discussed. I ask students to comment on what would make the viewing of the specimen easier, allowing them to brainstorm ideas, such as adjusting the amount of light on the specimen or methods of controlling the adjustable lens.

Students are now placed into groups of four. Each group must develop a presentation to explain how a microscope works. They may complete this in one of three methods: animated power point presentation, videoed “Science Report” with a submitted script, or a musical presentation involving images.