NZASE PEDAGOGY
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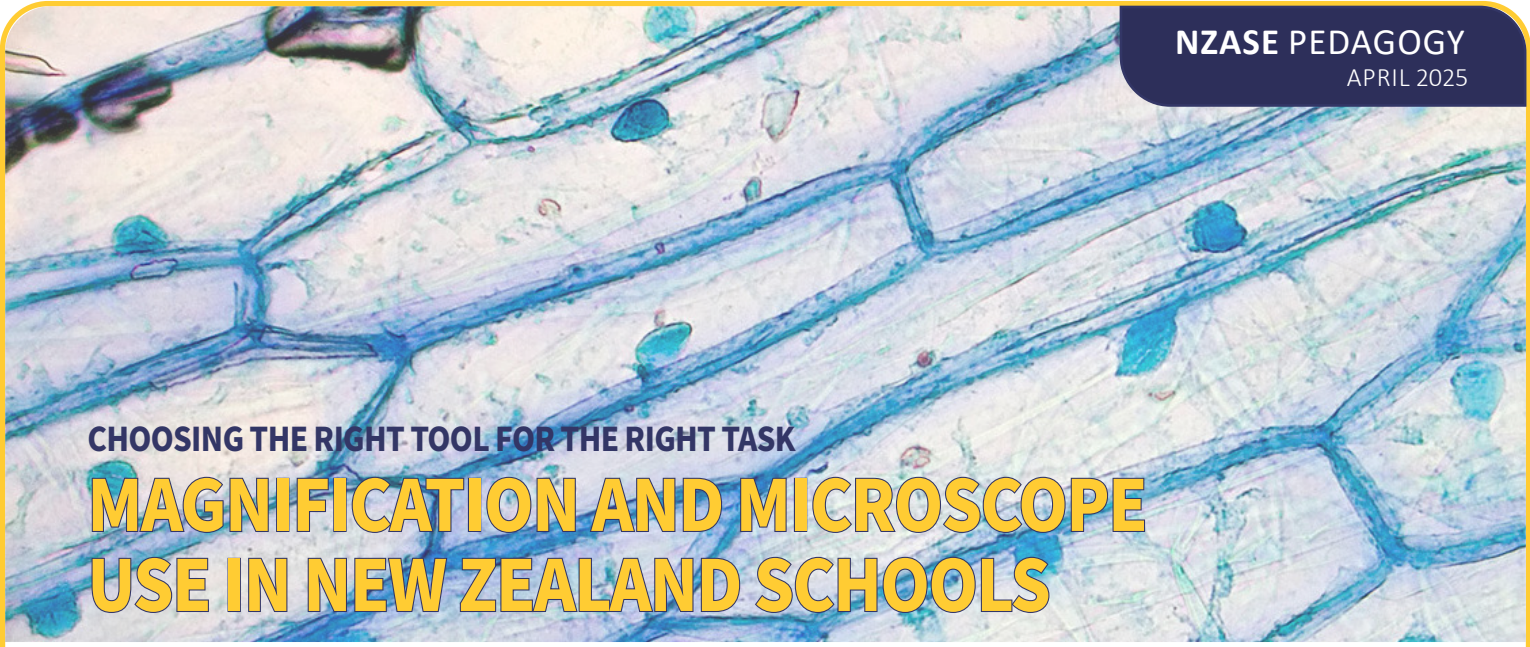


CHOOSING THE RIGHT TOOL FOR THE RIGHT TASK

MAGNIFICATION AND MICROSCOPE USE IN NEW ZEALAND SCHOOLS

Microscopes are an essential tool in science education. They offer students the opportunity to explore the microscopic world and deepen their understanding of living organisms. In New Zealand schools, the level of magnification required and the type of microscope used should align with the curriculum and developmental stage of students. Biology teacher Kate Greenslade explores the different microscopes available for all levels to ensure engaging and compelling learning experiences.

UNDERSTANDING MAGNIFICATION

Magnification is the process of enlarging the appearance of an object, typically measured in multiples (e.g. 4x, 40x, 400x).

Resolving power, which determines the ability to distinguish between two closely spaced points, affects the clarity of the image. Schools commonly use magnifying glasses, light microscopes, stereo and compound microscopes and digital microscopes, each suited for different purposes and magnification ranges.

The key factor to consider is what you want to observe. More magnification is not always better. It is about having the right tools for the job.

ABOVE: Onion cells stained with methylene blue so the nuclei are visible. Taken at 100x. Credit: kaibara87 (flickr).

MAGNIFYING GLASSES

To spark curiosity and introduce basic science concepts, a magnifying glass provides easy viewing of everyday objects and is ideal for observing 3D objects. The advantages include being relatively inexpensive (class sets), being mobile for exploration and being easy to use. Magnifying glasses can come in a range of styles with low magnification (2x - 10x).

Example activities:

- Examining leaves: sizes, colours and textures.
- Observing bugs: body part observations of

ABOVE: Loupe magnifying glass. Credit Heather Goodey.

ABOVE: Student using a loupe style magnifying glass to observe zooplankton. Courtesy Grounded Nature.

slaters, mealworms and beetles.
- Rocks and minerals: textures and compositions.
- Paper fibres: types of paper, such as newspaper, tissue paper and cardboard.
- Skin observation: patterns and textures of human skin, including fingerprints, hairs and pores.
- Fabric investigation: examining the weave and texture of various fabrics.

STEREOMICROSCOPES

These are also known as dissecting microscopes and with a low magnification (40x), they are ideal for observing larger, 3D objects, such as leaves, insects, or grains of sand, in more detail than a magnifying glass. They allow students to see textures and structures without requiring sample preparation. Stereomicroscopes are robust, user-friendly, and provide a wide field of view, making them perfect for younger learners with limited motor skills.

Example activities:
- Examining the veins of leaves.
- Observing the structure of feathers or flower petals.
- Investigating soil, salt, tiny seeds, sand particles and small insects.
- Examining head or pet hair, and fish scales.
- Newsprint, torn paper (colour magazines work well).

COMPOUND MICROSCOPES

Suitable for viewing thin, transparent specimens that either require preparation or are purchased on pre-prepared slides. The higher the magnification, the more costly the microscope.

LOWER MAGNIFICATION COMPOUND MICROSCOPES (40X - 400X)

Higher magnification and resolution than stereomicroscopes allow students to see finer details, such as plant cells, cheek cells or microorganisms.

Example activities:
- Observing onion epidermis cells stained with iodine to see the nucleus and cell walls.
- Examining pond water for microorganisms such as Euglena or Paramecium.
- Comparing plant and animal cells under the microscope with prepared slides.
- Stomata on the underside of leaves and pollen work well.

HIGH-MAGNIFICATION COMPOUND MICROSCOPES (UP TO 1000X)

Advanced light microscopes are ideal for studying bacteria, detailed cell structures, or mitosis stages.

Higher magnification enables students to examine fine details that are crucial for understanding biological processes. Using staining techniques, students can enhance contrast to observe features like bacterial shapes.

Example activities:

- Observing mitosis in root tip cells.
- Identifying different bacterial shapes in a microbiology experiment.
- Yeast colonies.
- Exploring specialised cells such as neurons or red blood cells on prepared slides.

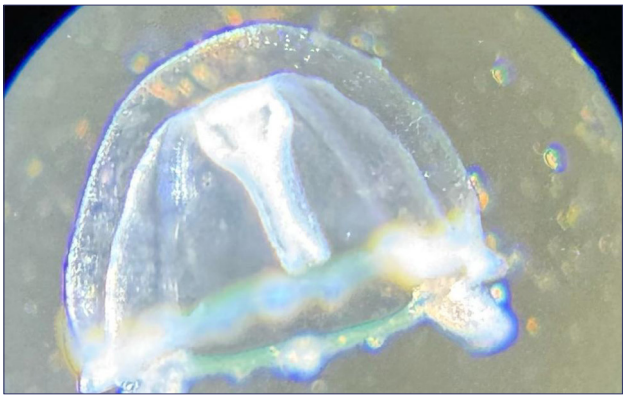
DIGITAL MICROSCOPES

Digital microscopes are an increasingly popular option, and their purchase is guided by budget and intended use. Digital microscopes typically connect to a computer or tablet, allowing for group discussions by projecting images on a screen or capturing images to add to documents. Zooming into an image can increase the magnification but not the resolution.

Often, one digital microscope is sufficient for a class to examine an image projected on a whiteboard. They are also useful for showing students what they should be looking at and avoiding focusing their attention on air bubbles on a slide!

Small, less powerful digital microscopes allow students of any age to explore their surroundings, collect images of 3D objects and share them. These are some of the most affordable digital microscope options.

It is possible to convert a standard microscope into a digital microscope. Purchase a microscope camera to mount over the eyepiece or with an over eyepiece adaptor. Alternatively, teachers or students can use a personal digital device (like a phone) to take a photo down the microscope eyepiece. They can then observe the magnified specimen, share the best images on Google Classroom and complete scientific drawings without relying on a shared group microscope eyepiece.



ABOVE: Image of zooplankton using an iphone and handheld digital microscope. Image: Rebecca O'Clerigh.

ABOVE: Bioviewer, slide set and informational booklet. Image: Kate Greenslade.

ABOVE: Observing a weta eye with a stereo microscope magnification: 16x. Image: Heather Goodey.

ABOVE: Students observing prepared slides through an optical microscope. Image: Kate Greenslade.

ALTERNATIVE OPTION: BIOVIEWERS AND PREPARED SLIDE DECKS.

These are made from tough plastic and give years of use in classroom conditions. They are designed specifically with a magnification set and are ready to view microscope images on a film slide, which can be purchased separately and cover a wide range of topics. Inexpensive and suitable for inexperienced students.

PRACTICAL CONSIDERATIONS FOR SCHOOLS

BUDGET AND ACCESSIBILITY

Light microscopes are a long-term investment, while magnifying glasses, stereomicroscopes, and digital options are affordable alternatives. Digital microscopes are particularly useful for collaborative learning and remote teaching. If you are looking for a short-term trial, consider reaching out to your local secondary school science department to see if borrowing equipment is an option. If this is an option, be aware that microscopes will need careful transport and handling.

TEACHER TRAINING

Effective use of microscopes relies on confident teachers. Professional development workshops can help teachers learn to prepare slides, use microscopes efficiently and troubleshoot common issues.

MAINTENANCE

Proper storage, regular cleaning and professional servicing ensure the longevity of microscopes. Schools should budget for maintenance alongside purchasing equipment.

CONCLUSION

By selecting the right tool for the task, schools can foster scientific curiosity and equip students with skills that extend far beyond the classroom. Proper planning and maintenance ensure that microscopy remains a vital and enriching part of science education in New Zealand.

LINKS

Microscope suppliers and services in New Zealand: kindly prepared by the Science Technicians' Association of New Zealand (STANZ), Te Rōpū Kaihangarau Pūtaiao o Aotearoa

RESOURCES AND LEARNING OPPORTUNITIES

Science Learning Hub: More information on magnification and resolution

How microscopes and lenses magnify

Different types of microscopes (light and electron) , their function, advantages and disadvantages.

Class resources: examples of things that can be explored using microscopy.

Connected series: Take a closer look - all about magnification and observation with great activities. L2 curriculum - full access including Google Slides.

VIDEO: BIOLOGY 10 - Basic Microscope Setup and Use