

Teaching geology to students with visual impairment (VI) Modifying geological materials for students who cannot see

The Earth Sciences use a wide variety of visual stimuli to communicate how our planet works. It is possible to make this accessible for students with visual impairments (VI). However, it does require some careful thought and adaptation for such students to be able to go through the same processes of observation and discovery as visually acute students.

Recent experience of preparing a student with VI (who was registered blind, with virtually no sight) for public examinations in geology required a new teaching approach in order to give this student a similar meaningful learning experience. This Earthlearningidea activity summarises some of the key lessons learnt from this experience.



Fig: 1 Example of a garnet mica schist specimen suitable for tactile interpretation. The weathering of the surface has left euhedral garnet crystals protruding. The shape of these can be determined by touch and used to identify the mineral and an interpretation can be made independently by a student with VI.

(Photo: M. Walsh)

The back up

Title: Teaching geology to students with visual impairment (VI) - 3

Subtitle: Making specimens and fieldwork accessible for students who cannot see.

Topic: Making geology accessible to all

Age range of pupils: All ages

Time needed to complete activity: Variable, with time taken to select specimens and locations, plan suitable activities and modify resources where alternatives don't exist.

Pupil learning outcomes: Pupils with visual impairments can:

- actively participate in learning geology;
- engage with real geological materials used so frequently in geology.
- share in learning, using these models alongside visually acute students

Context:

Perhaps the most challenging aspect of teaching geology to students with visual impairments is where students need to engage with real geological materials when they are working with specimens and undertaking fieldwork. It is very difficult to modify a rock specimen in the same way as other types of geological data (as discussed in the other ELIs in this series). It is important for students with VI who are learning geology to be able to make their own observations and interpretations of rock materials, both in the classroom and in the field, just as a visually acute student would have to do.

Specimens

Many rocks will have a similar tactile feel; crystalline rocks in particular can be very hard to distinguish between different textures by touch alone. Clastic sediments do provide some very good opportunities for a student with VI to describe and interpret a rock from specimens. The key to giving students with VI access to these materials is to carefully select specimens that are suitable for analysis by feel.



Fig: 2 A specimen of conglomerate that was used in teaching a student with VI. This specimen was selected as the different feel of the pebbles and the matrix allowed a student with VI to determine the size and shape of the pebbles, the grain size of the sandy matrix and from that to determine the sorting of the rock and to be able to draw independent conclusions about the processes that formed it.
(Photo: M. Walsh)

In order to give a reference for the interpretation of clastic sedimentary rocks (such as the one shown in Fig. 2), a tactile grain size card was made from a poorly sorted sand sample that was sieved to separate the different grain sizes and then stuck to a piece of thick card with PVA glue.



Fig: 3 A tactile grain size card made from sieved sand, thick card and PVA glue. The labels are made from self-adhesive braille strips, the writing was included to help the practical assistant. The tape around the edge of the card was added to make it durable enough to last the duration of the course.
(Photo: M. Walsh)

Where it wasn't possible to use a specimen where its texture could be determined by touch, a diagram drawn on Swell-touch™ paper was drawn (Fig. 4).

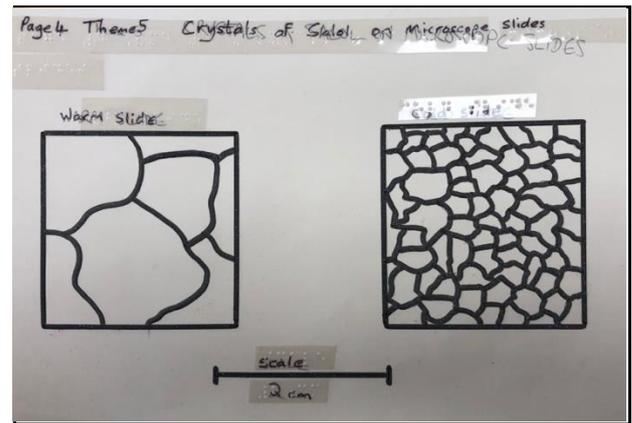


Fig: 4 A tactile diagram on Swell-touch™ paper illustrating the differences in crystal size from the salol experiment. Diagrams such as this can be drawn to allow a student with VI to understand the textures of rocks, particularly crystalline ones.
(Photo: M. Walsh)

It is also important to consider how a student with VI will record and use their observations and interpretations of specimens. Geologists frequently draw diagrams to represent their observations of specimens. However, it can be very difficult, if not impossible, for a student with VI to do this. Recording an audio description of the specimen or, for an assessment, to choose between different descriptions or tactile diagrams to match with the specimen.

Fieldwork

Geological fieldwork can be very challenging for students with VI, with issues relating to safe access to sites and ability to access the geology in these places. It is essential to consider both of these factors in deciding any location that it is to be used for field study.

Uneven surfaces that are typical of field study sites require very careful guiding for a student with VI to reach locations with an assistant dedicated to that role. The planning of any fieldwork will need to take into account the additional time that will be needed to move safely across any uneven surface.

Fieldwork needs to be planned to involve close-up study. Any exposure that is beyond arm's reach is effectively "invisible" to a student with VI. Consideration has to be given to giving such a student the opportunity to investigate the geology for themselves as much as possible, rather than just having it described to them.

An example of a successful field study was conducted on a series of weathered clastic sedimentary rocks, where a student with VI was able to discern the textures of rocks; sedimentary structures such as cross-bedding, ripple marks and desiccation cracks. The site chosen also had some small-scale faulting where the feel of the

different beds allowed the student with VI to determine the type of fault and to be able to measure its throw. This particular location even had some dinosaur footprints that gave a tactile investigative experience where the student could take measurements and make interpretations from their own results.

Where larger structural features are to be studied or for areas where the location of different sites is important, a diagram or map of the places to be investigated can be prepared on Swell-touch™ paper with Bumpons™. This can give some of the geological or geographical context of a location that more commonly would be done with an overview of a site which would otherwise be difficult to achieve for a student with VI.

For measuring dip, a tactile clinometer can be made using the ideas from the Earth Learning Idea – The DIY Dip & Strike Model using a tactile protractor fixed to a piece of wood to give it the level base required to place on a surface.

Conclusions

Practical work with specimens and fieldwork are an essential component of a geologist's education. It is possible for students with VI to engage with these learning activities with the careful selection of specimens and locations to be studied that allow for tactile gathering of information. It does require careful planning on the part of the teacher in order for these opportunities to be maximised for the student.

Thinking skill development:

- Building up a mental image from interpreting diagrams is construction.
- Cognitive conflict will occur as one interpretation is balanced against another.
- If a group of students discusses the outcome, then metacognition is involved:

- Application to the real world involves bridging.

Resource list for tactile visual resources:

- Swell Touch paper: <https://zychemltd.com/swell-touch-paper-for-tactile-graphics/>
- Tactile graph paper: <https://shop.rnib.org.uk/tactile-graph-paper-89877>
- Audio labeller: <https://shop.rnib.org.uk/braille-and-labelling/labelling/penfriend-audio-labellers>
- Wikkistix™: <https://www.wikki-stix.co.uk/>
- Bumpons™: <https://shop.rnib.org.uk/Products/SearchProduct?searchstring=bumpons> from the RNIB
- Tactile measuring equipment: <https://shop.rnib.org.uk/education/curriculum-subjects/stem>

Useful links: Earthlearningidea activities which might be adapted for use with students with visual impairment include:

- The DIY dip and strike model https://www.earthlearningidea.com/PDF/136_Dip_strike_model.pdf
- Identifying minerals - use your sense(s)! https://www.earthlearningidea.com/PDF/131_Identifying_minerals.pdf
- Rock detective - rocky clues to the past https://www.earthlearningidea.com/PDF/Rock_detective.pdf
- Found in the ground: sorted! https://www.earthlearningidea.com/PDF/155_Found_in_ground.pdf
- Fossil or not? https://www.earthlearningidea.com/PDF/What_is_a_fossil.pdf

Source: Mike Walsh, Cowbridge School, Wales with input from the ELI Team. Thanks to Roger Williams for work on modifying resources.

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