

Teaching geology to students with visual impairment (VI) - 2

Modifying visual resources 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.

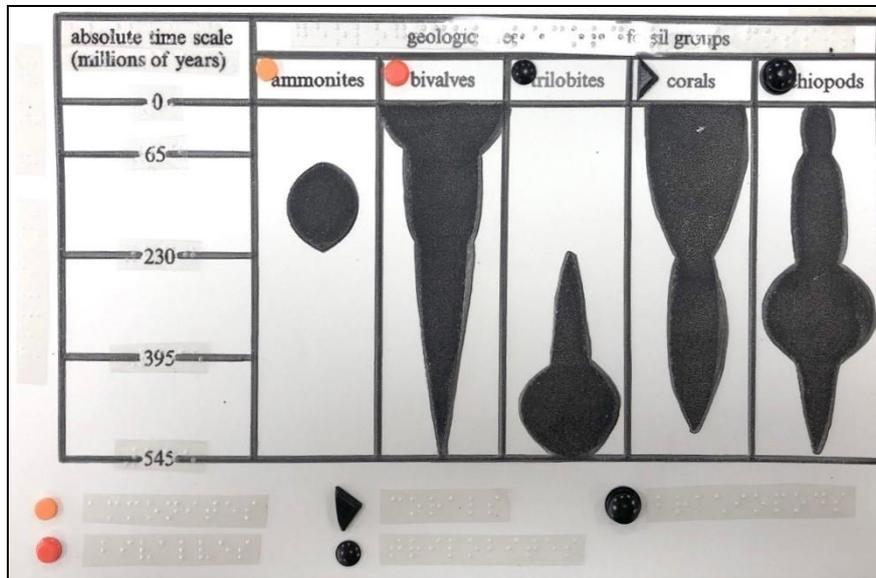


Fig: 1 A tactile diagram of changing fossil diversity over time produced on Swell Touch Paper™. The black lines and areas are raised so that they can be felt. All the text (included for the student's practical assistant to use) is overlain by braille strips. Bumpons™ are used for a key as the braille text is much larger than the typed equivalent.

The back up

Title: Teaching geology to students with visual impairment (VI) - 2

Subtitle: Modifying visual resources to teach students who cannot see

Topic: Making geology accessible to all

Age range of pupils: All ages

Time needed to complete activity: Variable, once the models have been made before the session.

Pupil learning outcomes: Pupils with visual impairments can:

- actively participate in learning geology;
- access the visual resources used so frequently in geology (diagrams, graphs, photographs etc.);
- share in learning, using these models alongside visually acute students.

Context:

Visual resources are a key part of learning geology. The frequency of their use and the variety of types employed in teaching and assessment of geology presents a significant challenge for both teacher and learner.

Wherever a visual resource is to be used in teaching it is crucial to consider first whether it is essential for understanding the concept being taught and secondly how it can be simplified. Any visual resource that is rendered as a tactile image will take a student with VI a great deal of time to explore and interpret as it has to be explored with a fingertip and it is not possible to get a quick overview of the image.

Whilst planning for a student with VI it was always important to give the student learning activities that mirrored what visually acute members of the class were engaged in. For example, a continental jigsaw activity (Fig. 2) was modified using thick card, braille labels and Bumpons™ (along with some sticky tack to hold pieces in position) to allow the exercise to be completed by touch.



Fig: 2 A tactile reconstruction of Pangaea made from thick card with Bumpons™ used to represent fossil affinities.

Diagrams:

Where a diagram is required it can be drawn on swell paper that will create a raised line following heat treatment, which may be followed by fingertip. Any diagrams created in this way must be simplified as much as possible with very careful consideration given to labels. Lines on a diagram that cross each other can be extremely confusing for a student with VI, therefore labelling arrows must be avoided or other tactile methods such as Wikkistix™ or Bumpons™ with a braille key can give a clearer way to labelling key points on a diagram.

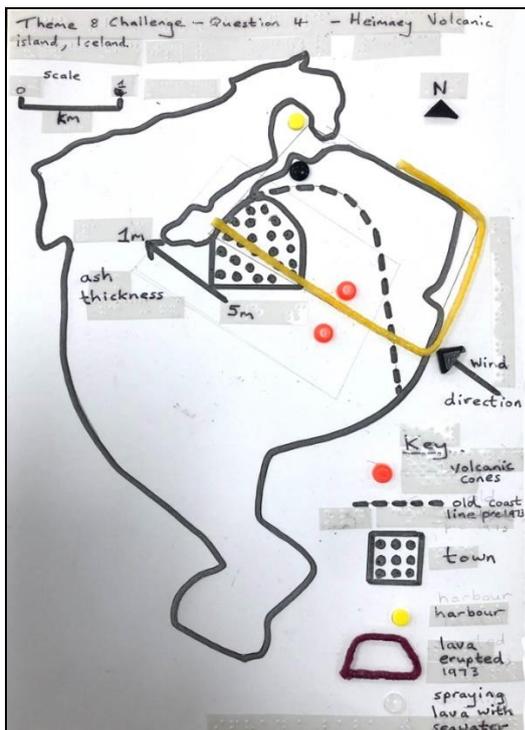


Fig: 3 A tactile map of the island of Heimaey, Iceland, drawn on Swell Touch Paper™. Note how Wikkistix™ have been used where lines cross each other to allow them to be differentiated by touch and that the use of labelling arrows has been avoided.

Three-dimensional diagrams, such as block diagrams, are extremely difficult for students with VI to interpret. Any such diagram needs to be redrawn as a simplified two-dimensional image (Fig.4) or replaced with a three-dimensional model/specimen for the student to work with. For example, using a specimen of a fossil or a model of a crystal rather than a diagram of one will be a far more effective stimulus for the student. One challenge faced was how to teach and assess dinosaur morphology; plastic toys (carefully selected for accuracy) proved to be an effective tactile resource for this.

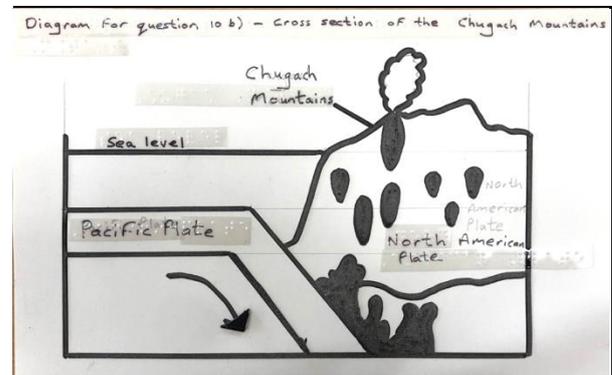


Fig: 4 A tactile diagram of a convergent plate boundary drawn on Swell Touch Paper™. The original of this diagram was a 3D block diagram with a lot more detail included. This was simplified and rendered in 2D to make it accessible

Graphs:

Tactile graph paper is available that allows a student with a visual impairment to plot their own graphs. If the paper is attached to a pinboard, points can be plotted using map pins and lines represented by string or wool or wire (Fig.6) to plot the lines between these points in a way that can be tactile. Wikkistix™ or Bumpons™ (Fig. 5) can also be used depending on the nature of the graph activity being undertaken.

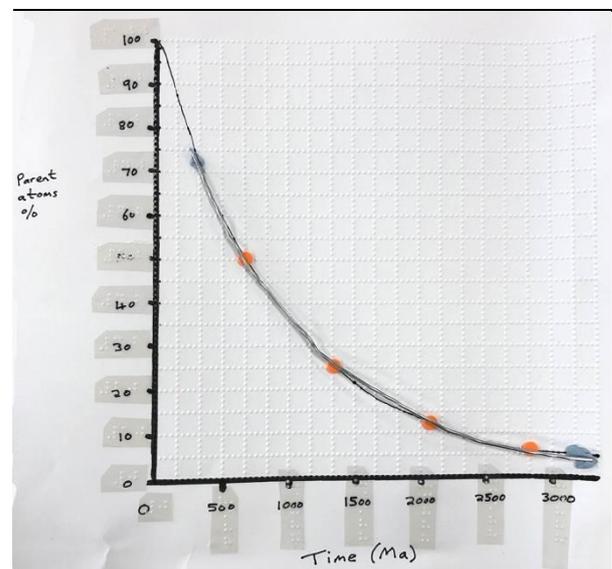


Fig: 5 A tactile graph of a radioactive decay curve where a student plotted half-lives with Bumpons™ as part of a learning activity.

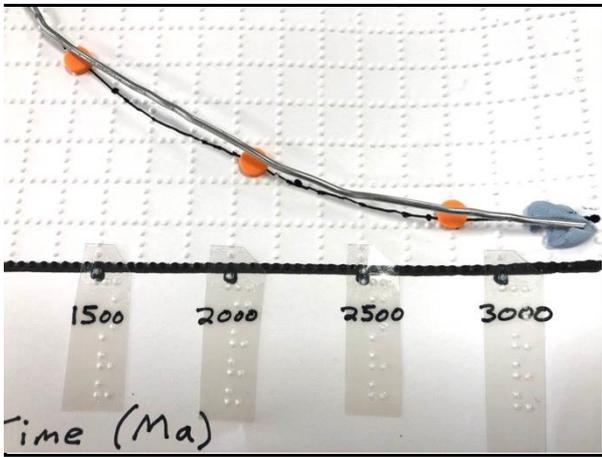


Fig.6 Detail of part of the graph in Fig. 5. Note the raised grid lines that allowed a student with VI to plot points on the graph, Braille labels on the axis and a piece of malleable wire (kept in place with sticky tack) that the student used to “draw” the decay curve.

Photographs:

Photographs are used a very great deal in teaching geology and they can be quite difficult to modify for a student with VI. How essential the photograph is to the lesson must be considered and how it can be modified. Photographs of features in the field can be reproduced as simplified field sketches using swell paper. Where a photograph of a specimen is used, the photograph could be replaced with an example of that specimen.

For essential photographs that cannot be readily converted into a simple line diagram, for example, satellite images or pictures of large landscape features, audio descriptions of the photograph can be recorded by the teacher. These can be audio files that can be made on a wide range of devices: however some thought needs to be given on linking the audio file with the piece of work being undertaken. There are audio labelling devices designed to make attaching audio files to documents straightforward; the PenFriend™ produced by the RNIB is one such example.

Video:

As the use of video resources in teaching geology increases it is important for students with VI to be able to access the key points. Documentaries made by major broadcasters can sometimes have audio-described versions available or the teacher could create their own audio description to listen to, as the class is being shown the video. Narrated documentaries can have enough information being given by the narrator that a

student is able to follow the points being made. Videos that show a process, such as a volcano erupting, that just has the sounds of that process should be avoided. It is possible for the teacher to check the suitability of a video resource by listening without pictures.

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

Useful links: See the first activity in this series for students with visual impairment:

https://www.earthlearningidea.com/PDF/419_Block_models_VI.pdf

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

- 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. All photos by M. Walsh. Thanks to Roger Williams for work on modifying resources.

© Earthlearningidea team. The Earthlearningidea team seeks to produce a teaching idea regularly, at minimal cost, with minimal resources, for teacher educators and teachers of Earth science through school-level geography or science, with an online discussion around every idea in order to develop a global support network. 'Earthlearningidea' has little funding and is produced largely by voluntary effort. Copyright is waived for original material contained in this activity if it is required for use within the laboratory or classroom. Copyright material contained herein from other publishers rests with them. Any organisation wishing to use this material should contact the Earthlearningidea team. Every effort has been made to locate and contact copyright holders of materials included in this activity in order to obtain their permission. Please contact us if, however, you believe your copyright is being infringed: we welcome any information that will help us to update our records. If you have any difficulty with the readability of these documents, please contact the Earthlearningidea team for further help.

