

## Activity 3: Learning Science

This activity asks students to identify and summarise key information from the 'learning sciences', and to produce a model synthesising the information.

### Overview of learning activity

In this activity, students (working in groups) engage with information about the brain and about learning, and produce two outcomes: a model of the learner and a set of 'tips for learners' that they could use as advice on study/revision skills for other students. The two tasks require the groups to organise and present information from the same 'database' in two very different ways.

### Rationale for the activity

The 'learning science' activity was partly intended to inform the development of metacognition (see Chapter 5), but - in common with a number of other activities - also involved a modelling activity. In the ASCEND programme this activity was also used as an introduction to modelling in science.

Deliberate aspects of the design of the activity included:

- Setting two tasks with different types of outcomes – the groups produced a summary sheet with key points about learning, in the form of tips for students, and a poster (although it would have been possible to use other media) modelling the learner as a 'system';
- Providing (as the primary source of information) a substantive text (included on the CD-ROM) that was not suitable for reading in full in the limited time available;
- Providing auxiliary information in the form of a diverse set of figures of relevance to different aspects of the text;
- Modelling of *modelling in science* by playing a slideshow of images.

The thinking behind the sessions included the expectation that some of the students would have rather limited notions of what a model in science could be, so presenting them with a range of examples of different types of model would be useful. For ASCEND a series of images were accessed from the internet (see below). These are not reproduced on the CD-ROM for copyright reasons, but it is suggested that is a useful approach to use when introducing students to the range of models scientists use.

Similarly, although a verbal text was produced as a principal source of information, this was supplemented with various visual images. This, along with the size of the text (over 4000 words, including new vocabulary and technical information) was a deliberate attempt to require the students to work as groups, and to plan a strategy for undertaking the work. In terms of the two outcomes expected, it was left for the groups to decide whether to subdivide into smaller teams to take primary responsibility for the different

outcomes, as well as deciding how to organise a way of searching the information sources.

The visual images were presented as a series of A4 cards each including one or two images, each with a legend (and an acknowledgement of the source). Again the images used were found from an internet search, and are not included on the CD-ROM for copyright reasons, but it is suggested that teachers may wish to develop their own library of useful images.

As well as adding complexity to the task, the set of images complemented the information in the text provided, and (paralleling information given in the text) offered information in alternative formats to simple written text.

### The scope of the text

The 'The brain and learning' text was designed to introduce a wide range of ideas related to learning, from both the psychological and the more physiological perspectives. The scope of the text may be gauged from the sub-headings:-

- Cells in the brain
- Perception
- Subconscious thought?
- Intuition and science
- Discovery and Justification
- The role of imagination
- The prepared mind
- What is learning?
- Meaningful and rote learning
- Learning style
- Multiple intelligences?

The text was deliberately designed to be 'dense' introducing a wide range of ideas, and new vocabulary for students to use. Consider the opening paragraph:

#### ***Cells in the brain***

A human brain consists of about 100 billion ( $10^{11}$ ) nerve cells, or neurons, supported by other cells (glial cells), bathed in a fluid (the cerebrospinal fluid) and supplied with blood. The glial cells have several different functions in the brain, but it is the **neurons** that are thought to be responsible for our *cognitive processes* (thinking – imagining, remembering, etc.).

The text relates familiar science ideas (the brain, blood, cells), familiar everyday ideas (imagining, remembering), and (what is likely to be) new concepts and vocabulary (glial

cells, cerebrospinal fluid). The text was designed to be a demanding yet interesting read for students. Gifted learners should have the ability to comprehend such texts, and it is important that they are able to engage with sources of this nature (which are somewhat different from standard school text books designed to meet the needs of a wide range of students with different levels of reading skill and interest in the subject).

Students need to have the ability to 'read for purpose' – to identify texts, skim them, determine whether they are relevant to matters in hand, and then select the parts of a text from which they will obtain information. Such skills are unlikely to develop when reading is limited to basic teaching texts, and students are always directed to particular passages for reading. Gifted learners (in particular) are likely to take more responsibility for finding a suitable source and interrogating it when they need information (see chapter 5).

During ASCEND a range of general science books (i.e. 'popular' science, mostly written for adults) of particular relevance to the ASCEND themes were made available in the teaching rooms, and some students did spontaneously use these sources, along with other reference books on hand, during some of the ASCEND sessions.

## Resources

The following resources are included on the CD:

Resource	Description	Filename
Briefing sheet	Instruction sheet for the groups	Act 3 Instructions
Response sheet	Summary sheet for groups to record their suggestions of tips for learners	Act 3 Learning tips
The brain and learning	Text providing an overview of thinking about the brain and learning	Act 3 Text

Two additional resources were used in the session, which are not reproduced on the CD-ROM for copyright reasons. However, it is recommended that teachers consider developing their own image libraries to build such resources.

### ***Modelling science slide show*** (using PowerPoint)

This consisted of a series of images accessed from the internet, offering an overview of some of the modelling that is used in science. The images used in the ASCEND project included models of space vehicles; model steam engines; model plane in a wind tunnel; replica dinosaurs; a model cell made from food stuffs; model cell from a biology course; molecular models (including the iconic DNA model of Crick and Watson); plastic life-size brain model; atomic structure diagrams; food pyramid image; schematic showing lock and key model of enzyme action; a representation of how mass distorts space-time; representation of magnetic fields around earth as solar wind varies; schematic showing biochemical pathways; mathematical formulae (being written on a board by Lise

Meitner); hologram of skull; as well as a range of other graphs, charts and schematics.

*Learning science image bank*

A series of images relating to the theme of learning and the brain. Each student group was provided with a set of the images to complement the text 'the brain and learning'. The images used, accessed from the internet, included: various images of the human brain (realistic, labelled images showing main brain areas etc.) including images supposedly linking to hemispheric specialisation and learning styles; schematics of nerve cells and connections; photomicrographs of cells in the brain; schematics of neural nets; common optical illusions; graphs showing outcomes of experiments on recall and forgetting (e.g. effects of reviewing learning); schematics representing ideas about hierarchies of learning skills, learning styles, and multiple intelligences; people undergoing brain scans of various types; and images from different types of scans. Some images with more indirect links to the textual material were also included: a fine art painting of a woman entitled 'intuition'; an image of a ring of snakes (inspired by Kekulé's report of his dream leading to the ring structure of benzene and other aromatic compounds); a painting of Pasteur (who commented on the value of a 'prepared mind' in scientific work) working in his laboratory, and one of the spaceship USS Pasteur (a medical ship Captained by Dr. Beverley Picard in the Star Trek Franchise). Some of the images included were intended to offer more 'creative' links to the theme.