



School of Geography & Geosciences
University of St Andrews

TEACHABILITY PROJECT

Creating an Accessible Curriculum in

GEOSCIENCE

for Students with Disabilities

at the University of St Andrews

SUMMARY

The traditional Geology curriculum presents severe problems of access to students with various disabilities. Physical impairment limits access to field outcrops, and the same difficulties arise with certain medical conditions such as post-viral syndromes. Visual impairment limits the use of the optical microscope for observing rocks in thin section. Some solutions have been implemented in the new Geoscience course at St Andrews that replicate the experience and achieve the desired learning outcome. Examples range from the simple case of bringing rocks to the student rather than *vice versa* to more technical solutions such as mounting a video camera on a microscope to provide an enlarged image on a personal monitor. A wide range of measures is being explored both in-house and nationally; particularly promising are virtual field trips now made possible by advanced IT. Some problems associated with the St Andrews teaching setting are also identified.

Hitherto *ad hoc* solutions have been devised and implemented (generally successfully) but it is proposed that a more formal procedure be adopted. Full participation in the curriculum of students with impairments is the goal of the new course and steps to achieve this are outlined. Considerations of disabilities issues will be included in future curriculum development. Significant problems still remain to be resolved and some of these are identified.

1 Introduction

This report is an analysis of the curriculum in Geology and Geoscience at St Andrews University from the standpoint of accessibility to students with disabilities. Training in geological sciences involves major field and laboratory courses as well as more traditional lecture and formal examinations. The report aims primarily to identify those aspects of current provision that appear to inhibit access to the course for various forms of disability, and it concludes with proposals for improvements.

Data for this report were gathered from several sources during session 2000-2001. Each member of teaching staff was surveyed for the arrangements they make for disabled students, and the data were compiled for a meeting of the Geoscience Teaching Council which considered the issues.

2 Background to Geoscience at St Andrews

Geoscience at St Andrews grew out of the Geology Department that taught BSc degrees in Geology from the 1920s until 2001. In 1997 the Department of Geology fully merged with the Department of Geography and the School now offers distinct degrees in both Geoscience (BSc) and Geography (MA & BSc). Most problems concerning accessibility to the Geography curriculum are common to Geoscience curriculum which, being a largely vocational course, has a range of additional problems associated with its extensive laboratory and field training programmes.

In summer 2000 the School relocated from a relatively modern 1960s construction (Purdie Building) to a traditional stone building (Irvine Building) which was partially refurbished for the purpose. The Irvine Building is not ideal for teaching and several problems of

accessibility were never resolved, most notably the absence of a lift in a building with the majority of its teaching rooms above the ground floor.

The curriculum for Geoscience was defined between 1998 and 2000, and the process benefited in the latter stages with the publication of the QAA Benchmark for Earth Science, Environmental Science and Earth Studies (ES³). Field training is at the core of the ES³ Benchmark and the new Geoscience course at St Andrews had adopted this emphasis. In fact, the extent of field skills training in the curriculum is a distinctive feature of the St Andrews course benefiting as we do from outstanding geology on the Fife coast and access to the Highlands within an hour's drive. A very large bequest for field training has enabled the School to increase field courses when most universities are cutting back for lack of resources.

Classes for the present Geology course and the incoming Geoscience course are typically 80 in 1st year, 45 in 2nd year and 20-30 in each of Junior and Senior Honours. Two-thirds of our graduates use their geological training to obtain employment and in recognition of this we will seek to have the course accredited by the Geological Society during the QAA process in 2002-3.

In recent years students with a range of impairments have successfully studied Geology or Geoscience at St Andrews. These include students with:

- restricted stature
- single upper limb
- severe visual impairment (but not blind)
- various post-viral conditions
- severe asthma
- various medical conditions such as haemophilia and severe cardiac problems

The following report benefits from the experience of working with these and many other students with impairments. We have no experience of students confined to wheelchairs or suffering from profound hearing impairment.

3. Core Requirements for the Geoscience Course

Geoscience is rooted in traditional Geology but differs by its emphasis on the Earth's surface and its interaction with humankind. The new curriculum at St Andrews is wholly consistent with the QAA ES³ Benchmark and its stress on field training amongst a range of practical skills.

Many of the more important data collected by geoscientists are visual observations, such as the identification of rocks, minerals & fossils, the creation and interpretation of maps, and the performing of instrumental measurements. Primary observations and sampling of rocks and surface features as they occur in the field are particularly important, and for this reason field

studies are central to this science. Indeed, one of the five common characteristics of the ES³ subjects is “their emphasis on field-based investigation”.

Practical skills as defined by the ES³ Benchmark include:

- the identification of rocks, minerals, fossils, and geological structures
- collection and documentation of geological information in the field, including the production and interpretation of geological maps
- surveying and measurement both in the field and the laboratory, and other qualitative, quantitative and instrumental techniques

In common with most other science subjects, generic skills include:

- use of IT for modelling, data analysis and report presentation
- oral, written and poster presentation of research
- use of information sources such as literature and the web

4 Accessing the Geoscience curriculum for students with a range of impairments

The General Case

In line with University policy of equal rights & opportunities no prospective student has been denied access to the Geology or Geoscience courses. Students with various mobility impairments, sight impairment and post-viral conditions have successfully completed modules.

The course literature encourages all applicants with impairments to consult with either the Head of School or the Admissions Officer. At this stage full information can be provided to the applicant about the requirements of the course. The same process is available to students already in the system as part of pre-advising prior to a new session.

The lecture still represents the principal means of delivering theory material to the student. In most modules approximately as many hours are spent in the laboratory as in lectures. The Geoscience laboratory consists of benches at desk height at which the student works at a microscope, or with rock/mineral/fossil specimens, or studies printed information such as a map or section log. Tutorials are relatively few in number, and restricted to first and second year; the smaller classes at honours and the frequency of working in small groups in labs and in the field tend to achieve the same objective. Field courses are conducted in all modules in all semesters. Among UK universities there is an unwritten target of at least 100 days of fieldwork over a full honours Geology course. Many universities fall well short but St Andrews exceeds this target in the new Geoscience degree. A wide range of assessment methods is used in the Geoscience course, including:

- traditional examinations (time limited written answers generally of essay type)

- continuous assessments of course work (eg lab notebooks, small projects, data interpretations)
- oral presentations of small-scale independent research projects
- field reports
- group projects with individual and group assessed elements
- research dissertation report
- lab tests

The University Course Catalogue allows reasonable flexibility to vary the precise forms of assessment. In the formal degree examinations, special arrangements, such as extra time and/or dictation facilities can be made for particular impairments. Greater flexibility is available to vary continuous assessments from the formal descriptions given in the School's Course Handbooks.

Within this teaching & learning framework the Geoscience Teaching Council adopts a policy of flexibility in teaching and assessment. In the case of any student with notified impairment the Head of School (or Module Co-ordinator) will adapt the formal procedure in an attempt to balance the needs of the student and the desired learning outcome. Sometimes this may mean the creation of an alternative item of teaching and/or assessment, other times it may require an alternative form of accessing the same teaching and/or assessment. Judgements of parity of learning outcome, or the equivalence of alternatives, are necessary and are always guided by the best information available on the student's needs and abilities.

Specific cases

Before applying to the University prospective students are encouraged to discuss any problems with accessing the curriculum that they may anticipate with a member of the School staff. It is possible that we might consider a particular impairment would render the course so inaccessible that a student would be strongly advised not proceed with an application. We have not yet been faced with this issue but it is recognised that there may be situations in which the offer of a place might not be made because of the uncertainty that the student could fully participate in the curriculum. These will be reviewed on a case by case basis.

On admission to the University our strategy is first to identify those students with any impairment. This information may come formally from the University Disabilities Adviser, the School Disabilities Co-ordinator, the student, the Class Tutor, or informally. When the full nature (and validity) of the impairment is established then a meeting with the student is arranged. Some combination of the Class Tutor, School Disabilities Co-ordinator, Chair of Teaching Council, and lecturer(s) on the course will be present at the meeting. If specialist advice is required then the University Disabilities Adviser may also attend. The aim of the meeting is to develop through discussion with the student a workable strategy for accessing the full curriculum. Solutions will obviously vary according to the impairment but details are passed to teaching staff (and if necessary technical and/or secretarial staff), sometimes

confidentially on a need-to-know basis. Responsibility for appropriate dissemination of this information is with the Chair of the Geoscience Teaching Council but may be delegated

Examples have occurred where the student has not formally or informally alerted the School of his/her impairment, but suffered the typical consequences of late assessments. Such a case came to our attention two years ago. A student who had lost so many marks for late submission of assessments was in danger of failing his degree. It was fortunate that during oral examination the External Examiner recognised his symptoms as a post-viral condition, being precisely the same as those of one of his postgraduate students. Although this case was satisfactorily resolved and all teaching staff have gained an important experience in differentiating such syndromes from malingering, such students may still fall through the safety net when their conditions are not easy to diagnose medically. An environment which makes disclosure easy for the student will help minimise such occurrences.

Mobility Impairment

A major problem specific to Geoscience at St Andrews University is the location of the Irvine Lecture Theatre (used for most 2nd, 3rd and 4th year lectures) on the 5th floor of a building with no lift. At present there is no means of access for wheelchairs; the previous occupants of the building used technicians to carry the student and wheelchair up and down stairs but this is not regarded as satisfactory. Students with mobility difficulties though not confined to wheelchairs will also find access difficult up three floors of steep stone stairs. A short term solution is a video link between the Lecture Theatre and the IT lab on the ground floor but this limits participation of the student in the lecture and can only be regarded as a stop-gap measure until the lift issue can be resolved. A possible short-term measure we may explore is the use of Wheelchair Corporation equipment which enables wheelchairs to climb stairs. Two seminar rooms, and the main honours laboratory are also located above the ground floor and suffer from the same problems and short-term solutions.

Field courses present the biggest challenge to the Geoscience curriculum. Many important field localities used throughout the course are difficult to access, for instance the Fife coastline and river sections and moorland in the Scottish Highlands. Alternative sites which are more accessible are sometimes available. We have carefully considered the contents of each field excursion and course and have students at Honours level undertaking alternative approaches to the same learning outcomes. Some teaching staff were initially reluctant to accept the equivalence of training, but have been convinced that this can be so. Examples of alternatives to site visits include:

- virtual field excursions
- video records of field excursions
- photographic displays
- use of samples collected *in situ*
- use of drill core material (sometimes available from surveys and exploration companies)

The School has a policy to train a technician in creating virtual field excursions. This has now started and the appropriate software (Macromedia Authorware, TRIADS

implementation) and digital cameras have been purchased. Over the next few years the technician will attend all field courses and generate support material for students unable to access the outcrops. All students will benefit from this approach as it is not possible always to get the best from a field excursion, eg in horizontal sleet in the Highlands. This is a good example of how the whole class can benefit from an action originally designed to assist disabled students.

Visual impairment

The recently refurbished Irvine Building is much improved for the visually impaired. Signs are clearer, high contrast colour schemes are used in corridors, stairs have white edges, and each room number is also indicated in Braille. Nevertheless, the building has a complex layout with mezzanine floors and navigating is difficult.

Accessing the curriculum is presently being addressed by working closely with a willing visually impaired student and the University's Disabilities Adviser. All course handouts are provided in advance in enlarged format and all staff have indicated their willingness for a tape recorder and small telescope to be used in lectures.

In laboratory classes microscope work provides the greatest challenge and this has been successfully met by attaching a small video camera to a standard polarised light petrological microscope with the image signal being fed into a personal monitor. With this aid the student can examine all the class material. Hand specimens are examined with the aid of hand lenses and other appropriate magnification tools. The classes are supported by demonstrators who can spend time with any student requiring extra assistance.

Field excursions are an additional challenge. The intention has been to use a companion to act as "buddy" in the field to describe the features and ensure safety. Unfortunately the main field excursion this Easter had to be cancelled because of Foot & Mouth epidemic restrictions on access.

We have not yet fully addressed the issues of how a student with no visual capability may access the curriculum.

Other Impairments

Students recovering from viral infections and with asthma are increasingly common in Geoscience classes at all years. Such students typically face two kinds of difficulty, namely (i) meeting deadlines particularly for assessments, and (ii) coping with the physical demands of field classes.

For students identified as recovering from viral infections considerable flexibility is applied to deadlines, and students are allowed to pace themselves through the work programme. Our arrangement for dealing with post-viral syndrome, asthmatic, and similarly impaired students who find some fieldwork arduous or dangerous to their health is to arrange a meeting between the field organiser and the individual student prior to the excursion. At that meeting they will assess which parts of the fieldwork are accessible to the student without unnecessary strain, and the leader will work out alternative arrangements so that an appropriate learning objective is achieved. In rare cases a total replacement programme is

worked out, in most cases however the student participates in the excursion but alternatives are found for the more arduous components.

Hearing impairments have not yet been encountered as a significant problem in accessing the course. Much can be done to provide written course material and to train staff to present oral material in a way suitable for lip-reading. There may be occasions when signing will be necessary in lectures, practical classes and the field. Hearing impairment should not prove a major barrier to accessing the curriculum.

5 Improving Accessibility to the Curriculum

Impairment-centred approaches

Building an audit of the needs of various impairments into the curriculum planning process places impairment considerations on a par with other constraints in curriculum design. For example, in the case of a field excursion this would mean taking into account all aspects, such as:

- physical accessibility to study areas
- facilitating observations in the field for visual and hearing impaired
- arranging appropriate logistics of travel, accommodation and subsistence

Promotional literature and student handbooks will be audited for the way in which disabilities are treated, with the aim of presenting an image of a positive, welcoming and inclusive study environment for all students.

Curriculum-based approaches

Our principles of curriculum development are based on providing the best possible education and training in Geoscience within available resources. Over the last thirty years the curriculum in Geology/Geoscience at St Andrews has undergone a major overhaul approximately once per decade. Further modifications occur in the intervening years, sometimes forced by changes in staff. At the heart of curriculum development is the learning outcome, and generally the best or most efficient route to that outcome is chosen. Recent efforts to cater for various disabilities have shown that alternative routes to the same learning outcome are possible, often without much extra demand on resources. Future curriculum development will aim to identify various means of achieving the same learning outcome, some of which should cater for various impairments.

The learning outcome of most field courses is the ability to make appropriate and accurate observations leading to an interpretation of some aspect(s) of the geology. Interpretation is required for many purposes, for instance to understand the geological history and evolution of an area, or to reconstruct past environments, or to locate mineral resources, or to locate sites for safe disposal of waste. While physical impairments may hinder the collection of raw data in the field (but other opportunities to acquire such data may be possible, as discussed earlier), the intellectual challenge of interpretation is common to all students regardless of impairment. Thus field courses should examine alternatives to the traditional means of

acquiring the necessary data. Lab classes have analogous issues relating to primary observations, for instance visually impaired students using the microscope. Similar strategies may be adopted.

In parallel with the skills training and intellectual training aspects, care must be taken to make sure that assessments are similarly designed to cater for impairments. A fair system will allow all students to acquire the necessary information in a manner appropriate to the individual situation, but it must be clear that the level of challenge is the same. For example, if a visually impaired student is given much longer to acquire data in a lab test, it is important that the class as a whole appreciates the reason. The “level playing-field” must be related to the challenge involved not some more arbitrary variable such as time. Similarly a physically disabled student might be asked to log a rock section in a series of road cuttings whereas the remainder of the class may be asked to log some crags or river cuttings. As long as the difficulty in interpreting the geology is comparable, such strategies should be acceptable to all reasonable students.

The Geography Discipline Network has addressed some of these issues on behalf of Geography, Earth and Environmental Sciences at national level. A recent meeting entitled “Learning Support for Disabled Students Undertaking Fieldwork and Related Activities” (May 2001) marks a major step forward and will help disseminate best practice in meeting the QAA’s Code of Practice relating to students with disabilities. The excellent advice and guidance for undertaking fieldwork with students with a wide range of impairments is accessible at <http://www.chelt.ac.uk/el/philg/gdn/disabil/index.htm>.

Physical Environment

This is a major problem at St Andrews University where Geoscience is housed in an old stone building (Irvine) on six different floors, the lecture theatre being on the fifth. First year teaching takes place on the ground floor but some second year and most Honours teaching take place on other floors. The lack of a lift in the Irvine Building is a serious problem for any student who has difficulty in using stairs.

Much of the practical course is carried out in “laboratories” which are large teaching rooms with fixed benches at desk height. The student will typically spend up to three hours (including break) at such a bench investigating materials. Special provision would probably have to be made for a student confined to a wheelchair unless it was equipped to vary height. Such provision need not be complex or expensive.

Teaching and Assessment Aids

Electronic aids such as video monitors, VCR, and tape recordings are routinely used for students who seek such assistance. Additional demonstrators can be provided in lab classes where one-to-one assistance can be provided where appropriate.

Major progress has been made in recent years in the area of Computer Aided Learning in Geology. Several modules were created (including one at St Andrews) and they were particularly effective in assisting students to understand principles from atomic scale to global scale processes. These were not designed specifically to assist students with impairments but are nevertheless useful. The new generation of IT application is facilitating the creation of excellent field simulations. We envisage that in the next few years a wide

variety of software will become available both nationally (co-ordinated by the National Subject Centre for Geography, Earth and Environmental Sciences) and locally using TRIADS software and in-house expertise. The web is also a growing source of useful “virtual fieldtrips”.

Evaluating the relative effectiveness of differing teaching styles for students with different impairments will be informative if students with identified disabilities are prepared to offer their opinions. In this way best practice can be shared and may involve the use of particular teaching techniques or aids. There are no technical barriers to the use of scribes in classes and assessments, just resource implications.

Implementation Steps

The following steps have been taken recently or will be taken in the coming session:

- ensure that appropriate information concerning disabled entrant students is disseminated among teaching staff at an early stage. The School Disabilities Co-ordinator will be asked to identify the necessary action steps
- continue to raise awareness and share experience among teaching staff. An expert from the Geography Discipline Group will be invited to address the School, perhaps on one of its strategic planning "away days"
- develop technical expertise in providing in-house courseware support
- appoint a Disabilities Co-ordinator within the Geoscience Programme (the School's Disabilities Co-ordinator is part of the Geography Programme). An appropriately proactive appointment will be made
- broaden the remit of the Geoscience Disabilities Co-ordinator to include strategic planning
- identify resources required to implement policy (for instance, the Equipment Committee will be asked to give high priority to the purchase of appropriate equipment). There may be cases where resources from outwith the School may be available
- include the School Disabilities Co-ordinator and, when appropriate, the University Disabilities Adviser in any planning of changes to the building
- liaise with University on means of solving the major access problems (see 6 below)

Barriers to Change

Awareness

This is perhaps the biggest barrier. Participating in the Teachability project has been successful in raising awareness. It has also demonstrated the value of being proactive in seeking solutions and that solutions to seemingly impossible problems are sometimes rather straightforward. The process has also helped teaching staff in the School to think carefully about learning outcomes and the possibility that these can be achieved in new and different ways. Raised awareness is, however, not in itself sufficient to ensure total access to the curriculum for the whole range of impairments and real barriers still exist to be overcome.

Training.

Specific training of teaching staff will occasionally be necessary. For instance, it might assist a deaf student if all staff were trained in lecturing styles that accommodate lip reading (describing slides in a dark lecture theatre is unhelpful but this is perhaps not obvious to everyone unless pointed out). Teaching staff and lab demonstrators might gain from a better understanding of how dyslexia and related impairments might influence three-dimensional thinking, a potentially important attribute in understanding rock structures.

Student reaction

Adverse reaction to favourable treatment of a subset of students is possible, especially when the impairment is not obviously disabling. Strategies for handling this situation are necessary, perhaps through the Student-Staff Council.

Accommodation

Old buildings are often difficult to access even when they have lifts to different levels. Accommodation refurbished to modern standards is not guaranteed to be easily accessible, as is the case for the Irvine Building, which was totally refurbished in 2000. For example, even on the same floor (level 3) there are steps that cannot be negotiated by a wheelchair.

Resources

Many of the strategies and solutions described have resource implications, often human resources (eg personal tuition), time, and technology. All have a direct or indirect cost. It is important that this is recognised and that some allowance for this cost is made by the university.

Communication of Accessibility

Promotional literature is clear about the extensive field component of the Geoscience course. Applicants are encouraged to contact the School to discuss the implications of any disability with regard to fully participating in the course, yet few do so. More students communicate with the University's Disabilities Adviser who contacts the School when necessary. More could be done to improve the School's information for applicants with impairments other than mobility.

Course Handbooks are issued for all sub-honours modules and a single handbook covers the honours course. These handbooks provide general information and logistics for the courses and include a brief section for students with disabilities. This section will be rewritten in more positive and inclusive language.

With the best will in the world there will be circumstances when accessing the curriculum becomes so difficult because of a particular impairment that it may be considered unwise to encourage the student in this direction. Legally, students can insist on entry to a course if appropriately qualified, and such situations must be handled sensitively. For example, a student suffering from agoraphobia might apply to take an Honours degree in Geoscience. Field training is at the heart of the St Andrews course and so this course would seem an unwise choice, but there would be no barrier to participating. Medical advice based on information supplied by the School would help the student make an informed decision.

6 Accessing Geoscience in the future

Based on experience, we are reasonably confident of students with disabilities similar to those itemised under (2) being able to access the Geoscience curriculum. A number of significant issues and challenges remain, including:

- a procedure for identifying resource implications
- how any extra costs will be met needs to be clearly defined
- access to a knowledge-base of solutions to similar problems elsewhere; reinventing the wheel is wasteful of resources. For instance, how can a student with no sight acquire the important skill of describing and identifying rocks and minerals? Someone, somewhere has thought about this.
- access to local training for handling specific impairments
- raising the status of the School Disabilities Co-ordinator
- the School and the University must consider how a student confined to a wheelchair would access the Geoscience course at Honours level. The Honours teaching areas in the Irvine Building are inaccessible except via the staircase. (It is understood that disabled access is being addressed in another SHEFC audit.)

7 Concluding statement

Adapting the Geology/Geoscience curriculum, with its traditional image of physical challenge, to make it accessible to the whole range of potential students is far from straightforward. Nevertheless the experience gained on this Teachability project suggests that much progress has been made and with some thought and modest resources a lot more is achievable. Although many recent changes have been introduced in response to new legislation it will be to the benefit of the subject and to society at large when barriers to accessing the Geoscience curriculum have been removed, or at least made manageable, so that the whole community is soon represented among its graduates.

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