Earth Science Senior Advisors

Annual Report 2008-2009

Introduction

In May 2008, Dr Jim Andrews (University of Southampton) and Dr Helen King (Higher Education Consultant) were appointed as joint Earth Science Senior Advisors to the GEES Subject Centre. This report details their activities from the period from 1st May 2008 to 31st July 2009; and provides an outline plan for the period 1st August 2009 – 31st July 2010.

Further information on any of these activities can be obtained from the Senior Advisors:
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The operational plan for 2008-09, developed by Jim Andrews (JA) and Helen King (HK), was based on the original Earth Science Action Plan devised by Neil Thomas in response to discussions by representatives of the Earth Sciences HE community in September 2006.

The original Action Plan specified five priority issues as follows:

1. Fieldwork organisation, teaching & learning;
2. Basic Skills in Earth Sciences;
3. Curriculum issues;
4. Recruitment and marketing of Earth Sciences;
5. Promoting motivation and scholarship in Earth Science students.

Particular activities were associated with each of these issues over the timescale 2007-2011.

Development of the operational plan for 2008-2009 also took account of themes raised by the Geological Society Education Committee and the Committee of Heads of University Geoscience Departments (CHUGD), and identified areas of work that had already been undertaken elsewhere. A small number of key activities were then prioritised for action.

1: Fieldwork Organisation, Teaching & Learning

1.1: Priority Activity: Running a field skills residential course for staff without the requisite background experience.

This idea was discussed by the Geological Society Education Committee and it was agreed that the week long course run by the British Geological Survey (BGS) should be used as the basis for the activity. Colin Waters of the BGS ran the course, including registering participants and managing logistics. Additional advice and input regarding issues such as teaching in the field was provided by JA. The specification for the course was developed in discussion with the Geological Society Education Committee and the programme and budget then negotiated with the BGS. The event was piloted with 8 participants and the cost subsidised by the GEES Subject Centre (from the Earth Science Senior Advisor budget) and the BGS.

The event was advertised to Earth Science departments across the UK and generated a reasonable amount of interest. 9 people formally registered from which 8 were selected to attend. A number of other departments expressed an interest in the event but did not nominate any participants. The event took place from 23rd to 27th March. It was based in Chesterfield and involved one day's training at Curbar Edge in the Peak District followed by four days mapping in Grave's Park, Sheffield. Formal presentations, exercises and time for inking-in were provided at the hotel accommodation in the evenings.

The training mostly focused on feature mapping of dipping beds of sandstone and mudstone. There was little exposure, though participants had the opportunity to undertake some section logging at a couple of localities. Colin Waters (BGS) provided the majority of mapping training and the benefit of his expertise and experience in the field areas. Jim Andrews supplemented his advice and guidance and provided additional information on teaching in the field. The tutoring was perceived as excellent by all the participants, e.g.:

> *The tutor-tutee relationship was excellent. There were plenty of opportunities for questions and discussion, which was good. There was also lots of learning by example in the field and time to discuss what was being seen.*
>
> *The course had a good balance of group and individual tasks which enabled me to learn from others and discuss my observations and thoughts. I liked the different inputs the tutors had to the course and their expertise in both mapping and teaching geological field skills made the course interesting and diverse.*

Curbar Edge, Peak District

Grave's Park, Sheffield

The participants' background was varied, some were geoscientists but had not undertaken detailed mapping, others were non-geoscientists including physics and biology. The course was received extremely positively by the majority of participants, for example:

> *The course content was at the correct level for non-geologists and the geology terms were explained very well. The practical exercises allowed us to work as a group as well as to think at our own pace. I enjoyed the evening sessions where I could use all the observations I had made during the field tasks to understand the geology of the area.*
>
> *I now am confident I could do a much better job when helping to teach students and in fact can probably use an abney level better than most of the Lecturers! I was also very pleased with the way my map was developing, it was not perfect or finished but I think it was really coming together.*

The only criticisms were regarding the late nights and the lack of exposure / variation of lithology. Some participants weren't sure whether the feature mapping would be used on field trips with students:

> *It might have been useful to have had an extra day at the start to cover all the theory/presentations etc, so that during the week we could concentrate on the mapping tasks. I found it hard to concentrate after 9pm or so, which was frustrating because the presentations that Colin gave were crucial for our understanding of the field mapping.*
>
> How relevant is this to the sort of fieldwork you'll be doing with students? *Pretty good, we don't tend to do a lot of the ... feature mapping rather than actually looking at rocks, I mean our second years we take out to Spain they've got complete exposure really, so don't do a lot of feature mapping but I'm sure it can help wouldn't hurt.*

These were seen as very minor issues by the participants and they understood that the long days were required to fit in all the work. Several participants expressed an interest in a follow-up course:

> *I would be interested in a follow-up course if the course examined a different lithology such as igneous or metamorphic rocks. I have recently returned from helping to teach a first year fieldtrip and was confident with most of the trip apart from practical exercises looking at igneous rock exposures.*[Comments sent after course and on return from a field trip with students]

Only one participant (a non-geoscientist) did not have such a good experience and they chose to leave the course at the end of day two. They supplied thorough feedback, explaining the ways in which the course did not meet their expectations. In summary:

- *It was more physically demanding than anticipated*
- *It assumed more prior experience of using maps than I had*
- *It focused strongly on detailed geological surveying rather than the basic field techniques I need to be able to teach to undergraduates.*

Conclusion

The field course was a great success and proved to be a positive experience for the majority of participants. In general the course provided an appropriate level of mapping training, though more exposures and a greater variety of lithology may have made it more relevant to the type of localities that students tend to be taken to. A few participants expressed the 'value for money' of the course (they only paid accommodation and travel expenses); whether departments would be willing to pay the full cost of a BGS-run course remains to be seen.

The Earth Science Senior Advisors recommend that a second course be run in the Autumn of 2010 using academic staff as the main tutors in a locality frequented by UK departments (e.g. Ingleton). Participants from the first course could be invited back both as a follow-up and to act as peer-mentors to new colleagues.

We would like to express our sincere thanks to Colin Waters and the BGS for supporting this pilot course and providing an excellent week of mapping training.

1.2: Additional Activity: the information collected by JA on field locations and their uses will be published on the GEES wiki by HK.

This information has been published on the GEES Subject Centre website (within the Earth Science pages) at http://www.gees.ac.uk/home/earthresources.htm#fieldlocs

If any department wishes to update their entry, please email helen@helenkingconsultancy.co.uk

1.3: Additional Activity: Thin Section Preparation Course

Following the Subject Centre's last 'Supporting the Supporters' event, Norman Morris from the University of Glamorgan offered to run a course on thin section preparation. JA corresponded with Norman and it was agreed that the course would be subsidised from the Senior Advisor budget to a maximum of £1500. The course ran from 9-11th September at the University of Glamorgan, though JA & HK felt that this was too soon to allow for adequate publicity. Information on the course was included in the GEES jiscmail and website. Only one participant registered for the course which went ahead anyway. Norman Morris requested support for evaluation, advice was provided by HK. The evaluation outcome has not been shared with the senior advisors as yet.

2: Basic Skills in Earth Sciences

2.1: Collation of Resources on Teaching Quantitative Skills

Numeric skills requirements for the Earth Sciences have been specified by the Geological Society as part of their accreditation scheme. A large number of resources on numeric skills are available on the Internet from UK and international sources. Information on these resources has been collated and made available by via the GEES Subject Centre website at http://www.gees.ac.uk/home/earthskills.htm

3: Curriculum Issues

3.1: Employer Engagement Survey

Discussion with the GEES Subject Centre Director and Manager indicated that **employer engagement and the outcomes of the Leitch report were items to be prioritised under this theme** (as indicated by the funding councils and the HE Academy). It was suggested that the Earth Sciences may already be very active with respect to employer engagement and that a useful activity would be to investigate the current state of play. A 'state of play' / baseline audit into the role of employer engagement was conducted as part of a wider project with Environmental Sciences funded by the HE Academy. A summary of the project was published by Sharon Gedye in the January 2009 edition of 'Planet' and can be downloaded from the GEES website at http://gees.ac.uk/pubs/planet/p21/sg.pdf

Earth Science Summary

This exercise was conducted as a series of telephone interviews with colleagues from ten Earth Science departments in English higher education institutions. Most interviewees were not familiar with the specific term 'employer engagement' but all suggested that it meant something along the lines of:

> *...a two-way flow of information between us and employers to ensure that the appropriate knowledge and skills are developed to prepare students for employment.*

All the interviewees expressed a strong sense of the rationale for employer engagement being about benefiting (undergraduate or postgraduate) students within the department; rather than for the direct benefit of the employer in terms of workforce development. Many departments noted that the high demand for geology graduates (particularly in the petroleum and mining industries) is such that employers are very keen to engage with HEIs in order to recruit.

In general terms, liaison with employers was seen as very important by 9 out of 10 of the interviewees and the tenth suggested that, although it wasn't currently important they suspected that it would become more so. The importance of links with employers was expressed in two ways, firstly as a way of ensuring the relevance of the curriculum and supporting the employability of graduates; and secondly, as a way of illustrating to students the relevance of geology to their everyday lives. The workforce development aspect of employer engagement was not considered a priority by any of the interviewees.

There did not appear to be any systematic difference in approach to employer engagement between old and new universities. Rather the differences appear to arise mainly as a result of the historical relationships departments have had with employers. Those that were involved in a considerable number of activities had done so for a long time either through links with research, a long-term commitment to employability or through the vocational nature of the degree courses. It should be noted that many Earth Science MSc courses are highly vocational and serve direct employment needs.

It is my impression (though this needs to be researched further to be verified) that the large multi-national companies (particularly in the petroleum and mining industries) have the scope to provide their own in-house training. SMEs, public sector organisations and consultancy-type businesses are more likely to take-up external training opportunities; however, the demand is not big enough to provide an economic incentive for HEIs to provide courses. As the list of training providers on the Geological Society website indicates, most CPD / workforce development provision comes from smaller, independent consultancies. HEI provision includes both academics going out to industry and employees coming in to the HEI to participate in undergraduate or postgraduate modules and degrees.

The most commonly quoted barrier to employer engagement was staff time; this agenda is hard to prioritise against research, teaching, administration and other demands on time. The two departments for whom there were no barriers noted that working with employers was part of the departmental / institutional culture due to the historical linkages with industry.

None of the interviewees felt that any support was required from organisations such as the GEES Subject Centre. Liaising with employers, including for workforce development, was seen as a departmental / institutional issue.

The full report from the Earth Sciences is available to download from the Earth Science pages of the GEES Subject Centre website at http://www.gees.ac.uk/home/discearth.htm

3.2: Research into Students' 'Sticking Points' in Learning Geoscience

This project aims to pump-prime research which will then form a strong foundation on which to build (and seek funding for) a larger-scale, internationally collaborative project. The outcomes will be threefold:

- A literature review of troublesome concepts in the geosciences;
- Research papers (for Planet and the Journal of Geoscience Education) describing the methodology, findings and conclusions / recommendations arising from the research;
- The development of an international research group on Threshold Concepts in the geosciences (interest has already been expressed by colleagues in the UK, USA, Canada, Ireland and South Africa).

The research is being undertaken by HK. An online survey and face-to-face interviews were conducted with geoscience staff and students at the University of Plymouth (March 09), the University of Calgary and the University of Colorado at Boulder (February 09). The data is currently being collated and analysed. The results of the research are to be presented at the GSA annual meeting in October 2009. HK has had an abstract proposal accepted for a special publication of the GSA on qualitative research and will also write up the project for the Journal of Geoscience Education. A summary paper will also be written for Planet.

4: Recruitment and Marketing of Earth Sciences

4.1: Priority Activity: conducting a review of outreach / recruitment activities in order to identify and promote effective models.

Student recruitment is a key issue for many Earth Science departments in UK higher education. A variety of strategies are employed to attract students both to the discipline and to individual institutions. In order to support this work the Earth Science Senior Advisors undertook a survey to identify and promote effective models of practice. All departmental contacts and heads of department were made aware of survey and it was also advertised via the Earth Science email newsletter and web page on the GEES Subject Centre website. The survey was made available to complete online through the 'Bristol Online Survey' tool. 16 responses were received from 15 departments out of a possible 39 members of Committee of Heads of University Geoscience Department (CHUGD: http://www.chugd.ac.uk/institutions.php) (38.5% response rate).

Summary

Respondents were asked to outline what they thought was their department's most effective strategy for promoting Earth Sciences to potential students. The most common responses involved **potential students visiting the department** and the **department interacting with schools**. Respondents were asked to select from a list which recruitment / outreach activities their department undertakes. The whole range of options were selected across all the departments responding, the most popular were **staff giving talks to schools** (9 departments) and **staff contributing to careers events in schools** (8 departments).

The Senior Advisors were interested to know which resources were being used by the Earth Science HE community. Four departments are involved with the **BGS Schools Seismology project** but **most departments use their own resources**. 8 departments stated that they were involved in **Ambassador-type outreach schemes**, the most popular (6 departments) being the Undergraduate Ambassador Scheme.

Respondents were asked whether they thought a more collaborative approach would boost interest in the Earth Sciences in the UK and, if so, what activities they thought might be effective. The overall response was **strongly in favour of the need for a collaborative / centrally-organised approach to support an increased awareness of the Earth Sciences** in general.

Three respondents provided additional comments, two of these suggested ideas for general awareness raising for the Earth Sciences. The third noted that the Scottish system of higher education provided an opportunity for Earth Science departments to 'recruit' students during level one, as they state "Enabling this transition from ES as one of 3 first-year subjects through to Honours is an important advantage of [the Scottish] system."

The full report has been posted on the GEES Subject Centre website. In addition to the analysis of departmental responses, mini case studies were obtained from 7 departments on a variety of recruitment approaches.

4.2: Additional Activity: Evaluation of the Undergraduate Ambassadors Scheme

Sending undergraduates/recent graduates into schools has become increasingly recognised as an important mechanism encouraging wider participation in further and higher education, particularly in strategically important science, technology, engineering and mathematics (STEM) disciplines. At the same time those participating benefit from exposure to the environment of primary and secondary education, enhancing their soft skills. There are an increasing number of schemes run under a number of banners with a variety

of stakeholders. Foremost of these are the National Undergraduate Ambassadors Scheme (UAS 2008a) and the Student Associates Scheme.

At a discipline level, the Royal Geographical Society has piloted an ambassadors scheme for the past 3 years and is now rolling this out nationally. The scheme recruits, trains and supports geographers currently at university and graduate geographers from the work place to act as ambassadors for geography in the classroom.

Recruitment to the GEES disciplines, particularly Earth sciences and environmental sciences and latterly Geography has come under pressure for a variety of reasons. Amongst these are the establishment of a National Curriculum in which earth and environmental sciences are embedded in other subject areas e.g. physics, chemistry and biology and the downgrading of geography as a core subject. Ambassadors schemes are viewed as a means of bringing geography, but particularly earth and environmental sciences into the classroom as specific disciplines which students may go on to study at university. There is currently little hard evidence available to judge how effective these schemes might be in this context or indeed in the wider context of the overall aims of the individual schemes.

The Earth Science Senior Advisors, with assistance from Joy Maloney (Faculty of Science Learning & Teaching Co-ordinator, University of Southampton) are conducting a small-scale, pilot research project to investigate the impact of the UAS scheme on participating GEES students and the pupils and teachers in their placement schools. Students from the Universities of Southampton, Leeds and Durham are taking part by sharing their UAS evaluation forms and administering a short questionnaire to the pupils at their placement schools. This research is currently in progress; a full report will be available for the November 2009 CHUGD meeting.

5. Promoting Motivation and Scholarship in Earth Science students

Following the foundation work undertaken on the above themes and in developing the network in 2008-09, this theme will be taken forward as a priority in 2009-2010.

Other Activities

In addition to the specific themes identified above, the following administrative activities were also undertaken:

- Identification of department contacts and learning & teaching champions;
    - The list of departmental contacts has been augmented with known 'champions' and any Earth Scientists who attended an event, wrote for Planet or received small-scale project funding since May 2000. The list will be maintained by HK and updated on a regular basis through correspondence with HoDs and the contacts themselves.

- Development of up-to-date content for the GEES Subject Centre and Geological Society websites (in collaboration with Mike Sanders and Jo Mears respectively):
    - HK has been given editing rights to both the GEES Subject Centre website and the education pages of the Geol Soc website. Details of Earth Science learning and teaching activities will be posted on the GEES site with links from the Geol Soc.

- Dissemination of a regular newsletter to contacts, champions and heads of department (to include information on specific Earth Science and relevant GEES and broader HE issues, resources and activities);
    - Two newsletters have been distributed to the email list to date and a third will be circulated in mid-May.

- Attendance at relevant meetings and events.
    - **Geological Society Education Committee**, May & Sept 2008 (JA)
    - Departmental visit to the University of Manchester, May 2008 (JA)
    - **National Academies Board on Science Education national workshop on STEM education research**, June 2008 (HK). HK was asked to present overview of geoscience education research in the US (http://www7.nationalacademies.org/bose/HelenKing_Report.pdf). Other disciplines giving presentations were physics and chemistry. Geoscience education research is still relatively new compared to the other disciplines and has many, exciting avenues to explore.
    - **ESTA Conference**, Sept 2008 (JA). Good contacts were made particularly with respect to the recruitment project.
    - As CPD, HK joined the University of Derby's Geohazard two week fieldtrip to the pacific northwest. As well as helping to revise her geological knowledge and visit some excellent sites, the trip provided the opportunity for 'sitting in' on the 3rd year students' experience.
    - **GSA Annual Meeting**, Oct 2008 (HK). She gave an oral presentation, chaired a session on Geocognition and presented a poster (jointly badged with GEES and the University of Plymouth) on researching threshold concepts in geoscience to raise awareness of the 'sticking points' research project.
    - **National Academies Board on Science Education national workshop on STEM education research**, Oct 2008 (HK). Although not offering a formal presentation she did have the opportunity to promote the work of the HE Academy with respect to discipline-based faculty development. The workshop convenors subsequently asked HK to write to STEM Subject Centres inviting them to join the project listserve.
    - **OPITO** meeting, Oct 2008 (JA)
    - In November, HK attended an 'On the Cutting Edge' **workshop on metacognition in the Geosciences**. As well as gathering some interesting examples of practice, some good

contacts were made and considerable interest obtained for future research in the area of threshold concepts / nature of geoscience.
    - With the above meetings (including attendance at the geoscience educator's reception and geocognition / geoscience education research meeting at GSA, HK has built on her existing network of contacts in the US. Amongst other benefits, this resulted in two colleagues (one from the US and one from Canada) offering to provide staff and student participants for the 'sticking points' research project thus adding an international dimension to the work.

- Supporting the central GEES Subject Centre activities as appropriate.
    - GEES Subject Centre advisory board, May 2008 (JA)
    - GEES Subject Centre conference on employability, July 2008 (JA)
    - GEES Subject Centre interview panel for dissemination co-ordinator, Nov 2008 (JA)
    - GEES Subject Centre team away day, March 2009 (HK & JA)
    - GEES Subject Centre interview panel for Director, May 2009 (JA)
    - Reviewing proposals for small-scale projects & student essay competition (JA & HK)
    - Reviewing Maskall & Stokes' fieldwork guide for the environmental and natural sciences (JA & HK)
    - JA liaised with the Earth Science community and Mike Sanders to provide input to the successful bid from the GEES Subject Centre to the JISC Open Educational Resources (OER) fund.
    - HK has contacted Cogent (the Sector Skills Council for Chemicals, Pharmaceuticals, Nuclear, Oil & Gas, Petroleum & Polymers) and arrangements are underway to meet and discuss common issues.