AR-02: Geophysics in Archaeological Fieldwork

Over the last decade, although student numbers have grown, the number of undergraduate dissertations involving original fieldwork has significantly reduced. This has many causes, such as concerns about health and safety, training in vocational skills, or student debt meaning a project based on close-to-home library resources is seen as more attractive than one spent in the field.

At Reading none of the dissertations recently have included the use of geophysics, even though the Department had acquired some specialist equipment such as Ground Penetrating Radar (GPR), and a relatively new member of staff now specialises in this technique. This is a shame, as fieldwork is one of the areas where undergraduates can make a genuine contribution to the creation of knowledge through the discovery and mapping of archaeological sites.

This project aimed to develop geophysics in three ways:

- to create an archaeological geophysics lab with access to a comprehensive range of equipment;
- to increase the number of undergraduates exposed to geophysics both within and outside the curriculum; and
- as a consequence to build capacity within the department of people with these skills to support colleagues' research and do their own, fundamentally linking teaching and research.

This project has been successful in that the new equipment, trialled by the undergraduates before purchasing, has led to their gathering primary research data and developing new fieldwork skills. As a consequence, academic staff have taken some of the students with them to work on their research projects, helping promote the blurring of the teaching/research divide.

Project Code: AR-02 Discipline: Archaeology Project Title: Geophysics in Archaeological Fieldwork
Description: : Few undergraduate dissertations now involve fieldwork and none use geophysics even though a relatively new member of staff now specialises in this technique and the Department has acquired some specialist equipment such as Ground Penetrating Radar (GPR). This project aims to develop geophysics in three ways: to create an archaeological geophysics lab with access to a comprehensive range of equipment; to increase the number of undergraduates exposed to geophysics both within and outside the curriculum; and as a consequence to build capacity within the department of people with these skills to support colleagues' research and do their own, fundamentally linking teaching and research.

A **What is the perceived problem or challenge?**	B **Enabling Factors** What resources will facilitate the project?	C **Processes** How is this project going to be achieved?	D **Objectives** What is the end product or result of the project?	E **Evaluation Data** What methods can be used to demonstrate the success or impact of this project?	F **Unintended consequences** What have been the unintended consequences of enacting this project?
National perspective Archaeological contractors complain that graduates do not have enough field-experience **Student perspective** The existing undergraduate geophysics module is mainly taken by Environmental Science students rather than archaeologists. Archaeology students' exposure to geophysics can be limited to one lecture in Part 1 and an optional section of a Part 2 module. Most dissertations are now library based, few are fieldwork based and no undergraduates have used geophysics, despite routine survey work being relatively straight-forward. **Staff perspective** The School has some high-end Geophysical equipment (e.g. GPR) but only one standard gradiometer and resistivity, meaning that only very small groups can be taught. The shortage of students conversant in geophysics restricts support for staff and student research projects. A technician relatively new to geophysics requires support to build up capacity to support geophysical teaching and research.	**Capital investment** CETL will fund the creation of a Geophysics project room which can be used by undergraduates, postgraduates and staff, where PCs will exist with all the requisite software; filing cabinets and back-up hard drives will exist for all survey data to be archived in; and a small library will be created to support this kind of work. **Equipment** New equipment will be purchased including: Three dual sensor gradiometers The RM15 Resistivity rig will be comprehensively updated The range of Magnetic Susceptibility kit will be extended for Archaeological and Physical Geography's use Laptops and extra software licences for fieldwork A new minibus will be purchased for this and other projects to facilitate fieldwork **Staffing** A Teaching Associate with geophysical experience will be appointed to help develop these resources.	One or more large-scale projects (such as the survey of an entire Roman Town) will be undertaken by students to raise the profile of the department's resources. **Student Perspective** The TA will foster the creation of a student fieldwork group doing occasional surveys in the vicinity of Silchester. The TA's role will be motivational rather than running the group which needs to become self sustaining. **Staff Perspective** Keeping a log of students who have gained experience in geophysics will mean that academics know who to invite to assist them on their own research projects. Working with both a TA with experience in Geophysics, and with Dr Creighton,and in addition with Dr Astin, will support the technician's experience with the equipment. The following resources/ guides will be created: 'how-to' guides for the use of both Geophysics equipment and some associated surveying. How geophysical data can be directly inputted into GIS.	**Institutional perspective** Reading will be known to have a comprehensive suite of geophysical equipment which can help attract research students, some from former UG students building on their earlier experience here. Reading will produce more Archaeology graduates with experience of geophysical fieldwork techniques. **Student perspective** More Archaeology students will develop specific Geophysics skills whether within taught modules or other opportunities. More will undertake fieldwork-based dissertations involving Geophysics. **Staff perspective** More UGs/PG-Ts/PG-Rs will be trained and able to help staff in their field research. Fieldwork in the vicinity of Silchester Roman Town cumulatively builds up into a more comprehensive picture of its environs, advancing research into this major archaeological resource. **Staff & student perspective** A quality work environment will motivate staff and students. The showcase for this will be the Geophysics Lab, posters in the department, and web pages.	Monitor usage of the Geophysics Lab **Student Impact** Log number/proportion of dissertations involving archaeological geophysics and UG and PG-T level. Monitor whether information-sheets, posters and guides have been created and evaluate their usefulness in achieving their learning objectives. (interview with students doing geophysics projects) Monitor how many UG Archaeology students are exposed to geophysics (in modules and extra-curricular involvement) Monitor whether there has been an increase in related postgraduate recruitment (Log the number of PhD research topics involving archaeological geophysics, and if the students had studied at Reading before). **Staff impact** Log whether there has been an increase in students supporting academic research projects using geophysics (log of students doing geophysics on staff projects, and structured interview with those staff).	

AR-02: Geophysics in Archaeological Fieldwork

1. Project Progress and Timeline

1.1 Timeline

Done	Project stage post	Planned end date	Actual date
Equipment Procurement			
☒	Evaluation in the field of gradiometers	Jul 05	Jul 05
☒	Tendering & purchase of gradiometers	Feb 06	Feb 06
☒	Furniture & IT Equipment in Geophysics Lab	May 06	May 06
Creation of guides and support materials			
☒	Creation of 'information sheets on techniques'	Nov 06	Nov 06
☒	Creation of 'how to guide' gradiometery	Feb 06	Jun 06
☐	Creation of 'how to guide' resistivity	Feb 06	partly drafted
☒	First large-scale survey (Silchester)	Aug 06	Aug 06

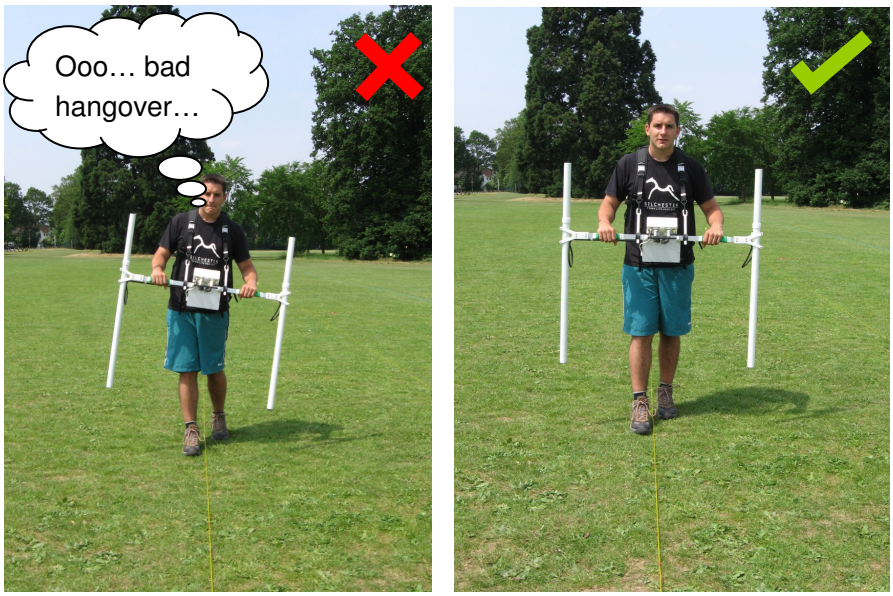
1.2 Enabling Factors: State the resources used in this L&T-enhancement project

There were three aspects to the resources that have gone into this project:
Firstly, the technical and staff interest in geophysics had primarily been in deep-earth techniques (with a geological emphasis), and with the closure of PRIS (the Postgraduate Research Institute for Sedimentology), this created an opportunity for a shift to align geophysical work with archaeological research. The old geophysics laboratory was decommissioned (to make way for the CETL office), and a new office in the research area of the Geoscience building was converted into a 'clean room' with PCs for geophysical processing and research (Geoscience 132; c. £7K).
Secondly, new surveying equipment was purchased (three dual sensor Bartington gradiometers; one new four-probe mobile resistivity rig, and some new peripherals for our magnetic susceptibility equipment – c.£47K).
Thirdly, the Teaching Associate was employed, helping Dr John Creighton (CETL Director) and Dr Timothy Astin (lecturer in Geophysics), and Dave Thornley (Geophysics Technician) in drafting information sheets and guidelines, as well as assisting on field-projects.

1.3 Processes: What were the key challenges in delivering this project?

Identifying the equipment to purchase was done by trialling that from three different suppliers with some of the current undergraduates during the Silchester Fieldcourse in the summer of 2005. They found one set clearly easier to use, and they obtained excellent results using it. These were then purchased.
A *Teaching Associate* was appointed, but was only in post for six months before emigrating (see 'Teaching with Material Culture' evaluation). During this time she spent c.4 months working on geophysics projects, drafting guides to the new equipment, and helping facilitate our first large-scale survey, where the intention was for every first year student to gain experience of using this equipment (which we virtually succeeded in). In creating

the guides she was assisted by Rob Fry, an undergraduate, who checked the guides for comprehension and posed for some of the action shots in them…



Above: Shots from one of the student equipment guides

The final challenge was making colleagues aware that many students now had experience of these techniques and could assist them on their research projects gathering data – if not actually processing it (which some could do) and producing a professional report (a little beyond them at this stage). However uptake was rapid and good and is set to build.

2. Outputs and Evaluation

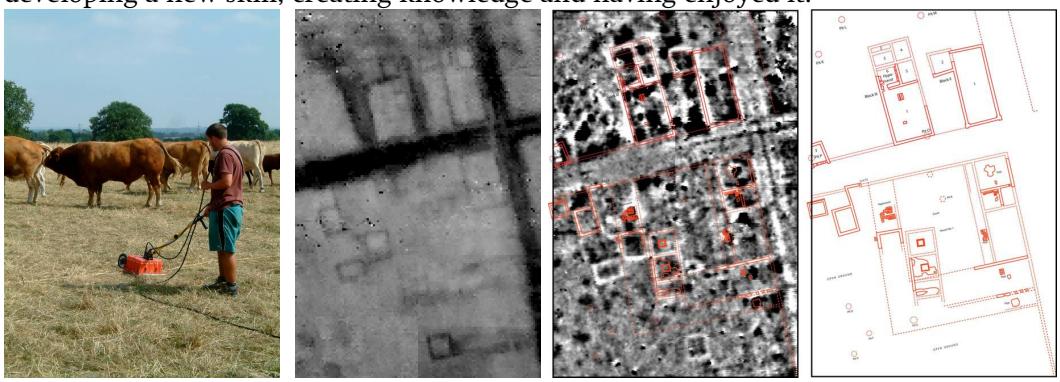
2.1 List the evaluation evidence/data collected

Date	Quantitative/ qualitative?	Evaluation by	Description / Method
Aug 06	qualitative	Students (various)	Students keep a diary of skills development at the Silchester training excavation.
Aug 06	quantitative	Monitoring data	No. of students using geophysics on course.
various	quantitative	Monitoring data	No. of students using geophysics in dissertation projects. Data collected since 2003
various	quantitative	Monitoring data	No. of students using geophysics of staff research projects. Data collected since 2004

2.2 Summarise the key results from your data

By involving undergraduates in the selection of the equipment we purchased, it meant that when it arrived some of the group had an immediate sense of 'ownership' or responsibility towards it. A core group of three students came and thoroughly field-tested

the equipment on a research project by John Creighton in central France (the Roman sanctuary site at the *Source de l'Yonne*). In the Summer of 2006 all the Part 1 students spent two days each using the equipment (some more) doing a complete survey of the entire interior of the Roman Town of Silchester. While about 25% of the results needed re-doing (which is still very good for beginners), this showed perfectly acceptable primary research data could be gathered by novices. It also suggests that the guidance material we created was broadly working. The students also gained immediate feedback on their discoveries as the data was processed at the end of each day, and they felt an immediate pay-off or reward, especially when things were pointed out to them which were totally new discoveries, unknown from earlier archaeological excavations. Many of the students remarked favourably on the geophysics in their Fieldschool diaries, commenting upon developing a new skill, creating knowledge and having enjoyed it.



Above: Silchester (a) Ground Penetrating Radar in action (b) resistivity results from a small area (c) gradiometery results from the same area (d) plan of the same area from the Edwardian excavations.

One of the interesting points was that we had students who already had a day's experience using the equipment teaching the new students how to use it. This reinforced their own knowledge and gave them a confidence boost (and the information they passed on was largely correct!). It also helped make the work on such a large scale with so many personnel sustainable in terms of alleviating the academic staff time input necessary.
Later in the summer of 2006, some of these students went on to work on other staff research projects, with Dr Hella Eckardt on the Romano-British burial mounds at Bartlow Hills, and on Prof. Steve Mithen's project in the Scottish Highlands and Islands.
During Summer 2006 one student undertook for a dissertation a comparison of all the geophysical techniques at our disposal of Reading, as applied within one street-black at Silchester Roman Town, and three others are planning geophysics-based dissertations for 2007/8. These undergraduates, as well as research students and staff, have been using the facilities in the Geophysics Room to process data.
The departure of our TA has meant that having someone present to go out with the students and the archaeological society to do extra-curricular surveys has not progressed, and a 'big' survey project for Summer 2007 will not take place, though with the reappointment of this post in May 2007 it is hoped to re-instigate that plan, so again this element is delayed rather than problematic.

2.3 How would you, as the PI, summarise the success of this project?

Reading staff and students have demonstrated that they now have the capacity to undertake large-scale survey work, rapidly. The students have demonstrated that many of them (c.75%) can develop the requisite skills to obtain acceptable data by largely training themselves. Students are going on to help other staff on their research projects, and whereas a few year back no students had undertaken geophysics-based dissertations, that number is now growing, and we are confident will continue to do so as awareness and the results from these surveys are disseminated.

3. Impact and Consequences

3.1 How many students (and at what level and in which programme areas) has this L&T enhancement project impacted on?

During the Silchester Fieldschool, about 60 students (all the Part 1 Archaeology BA/BSc students, and some from joint programmes) all had two-days experience of using geophysics. Other people at all levels are however using the equipment, though in a small way, though we expect to build this up as the 2005/6 part 1 cohort progresses its way through the years.
Students on the *Environmental Science* programmes also gained some experience of this equipment.

3.2 Has this project positively contributed to the teaching environment and satisfaction of the academic staff delivering this provision?

Yes. The Silchester survey demonstrated that massive areas could be covered by student-survey producing publishable results and creating a genuine contribution to knowledge. This is largely a tribute to the design improvements in the latest equipment (in the past similar equipment was temperamental and required a great deal of experience to obtain reasonable let alone quality results). Secondly, as Academic staff take undergraduates with them on research projects, this is helping promote the blurring of the teaching/research divide, and help lead to a valuing of the contribution undergraduates can make to the creation of knowledge.

3.3 Summarise the unforeseen consequences of this project

The evaluation of the equipment provided by different suppliers has also been used by various other University Departments to help inform decisions as they plan for new equipment.
The presence of a rather large Limousin bull in the area due to be surveyed at Silchester did mean that both technical and academic staff involved, together with select students, are now conversant in electric fence erection and maintenance, and the health and safety issues surrounding them for both humans and livestock. Something else to add to the *CV*…

4. Dissemination

4.1 Log dissemination activities relating to this L&T Project.

Date	Main Audience	Type	Dissemination activity
Nov 05	UoR Students	Information	Geophysics Part 1 lecture: highlighting possibilities for extracurricular work.
Nov 06	UoR Students	Information	Geophysics Part 1 lecture: highlighting possibilities for extracurricular work.
Nov 06	UoR Students	Information	TA presentation to Archaeology students about the equipment and possibilities for extra-curricular opportunities

4.2 Beyond this evaluation, do you see any scope for pedagogic research in this area of learning?

There may be a case study in the method of peer support, getting students to train other students as a method of learning.

Project Developer's names:

Project Manager:	Dr John Creighton (CETL Director)
Teaching Associate	Laura Cripps
Technical Support (Geophysics):	Dave Thornley (SHES Technician)
Academic Support (Geophysics):	Dr Timothy Astin