

Final year research projects in communicating science

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Background and rationale

We offer a range of final year project types to undergraduate students in the department, who are studying for degrees in Biomedical Sciences, Biochemistry, Biology and Forensic Biology. While laboratory-based projects remain the most popular, we also offer projects involving non-laboratory based research training: literature-based dissertation projects, computing-based projects and business plan projects for those who wish to gain valuable transferable skills in addition to experience of cutting-edge scientific research. Recognising the need for effective communication of science and seeing an opportunity to embed science communication activities and public engagement into the undergraduate curriculum, we added 'science communication projects' to the portfolio in 2004 to provide students with a more challenging outlet for those with an interest, enthusiasm and aptitude for communicating science to non-scientific audiences (Lloyd, 2007; 2006). This has particular resonance today in a period of rapid scientific progress but declining interest in science among the general population. It is also congruent with a number of initiatives from Research Councils and charitable organisations to promote public engagement.

In addition to the generic learning outcomes for our final year projects concerning research skills, appraisal of literature, critical thinking, and making and defending scientific arguments, we have specific learning outcomes for each of the project types. Successful completion of a science communication project should lead to:

- An in-depth understanding of an advanced research topic;
- An ability to write in clear and lucid scientific style;
- An ability to simplify complex scientific information;
- An appreciation of how knowledge must be adapted to suit the audience; and
- The ability to make science interesting, accessible and fun.

The learning outcomes are met and assessed by the completion of three specific elements:

- 1) A dissertation, 6,000 words long, reviewing in-depth the scientific literature related to the project.
- 2) An oral presentation, in which this research, or aspects of it, are presented in a way that is interesting, accessible and inspiring to a non-scientist. This element of the project is delivered and assessed in local schools.
- 3) A communication piece, which can be a magazine article, interactive CD-ROM/ website, museum display or other piece that communicates the science in a different media.

How to do it

Preparation

Before embarking on such projects, the project coordinator needs to engage with colleagues to ensure science communication projects will be fully embedded within the department and not marginalised. Each student needs a supervisor, so there needs to be enough staff willing to supervise them. Introducing them at Kent wasn't a problem — colleagues recognised science communication was important and was lacking in other parts of the curriculum, and the final year research project offered an extended period to engage fully with this important element of scientific activity. From a purely practical point of view, communication projects are a lot less intensive in terms of supervision than laboratory-based projects, and also less costly for the department as a whole — a big selling point for time- and cash-pressed academic staff! Guidelines and mark schemes need to be written to inform both students and supervisors (see accompanying material). Quality assurance procedures may vary across universities, but at Kent it involved a minor change to the module specification and Faculty level approval for additional learning outcomes prior to running the projects for the first time.

Timeframe

Project selection and assignment takes place in the first 3 weeks of the autumn term. The communication projects usually concern a topical, controversial or poorly understood area of science, and past examples have included the use of stem cells in medical research, the use of performance enhancing drugs in sport, and the potential impact of biological weapons. The titles and abstracts can either be put forward by the project coordinator or, preferably, prepared by potential supervisors before circulation to students. The remainder of the term can be used for reviewing the literature, although the main body of the project takes place in the 12-week Spring term. The deadline for handing in the dissertation and the communication piece is the last day of the Spring term, while the talks take place in mid-March — we coincide our talks with National Science Week to generate added publicity in liaison with the University Media Office. This timeframe works well within our 12-12-6 week term structure but may need adapting in other departments.

Student support

We advise weekly meetings with supervisors during the spring term (which students are responsible for organising), and these are supplemented by two student workshops. We advise students to begin working thoroughly on the dissertation, which accounts for 40% of the project mark; aside from this being a high proportion of the project marks as a whole it is important that students achieve a depth of understanding on the subject and that this in-depth knowledge underpins the 'science communication' elements of the project. The workshops help students to develop strategies for communicating science by dissecting their own learning experiences, and they leave the workshops with a tangible outcome — a 'checklist' of good and bad practice — which they can apply to their own work projects in describing their scientific research to non-scientists. Within these workshops, the students can put these checklists into practice; they are given examples of challenging scientific concepts and work in groups to develop ways of explaining them to a non-specialist audience using a variety of media. The students leave the workshops fully aware that presenting entertaining and interesting material that does not cover any scientific concepts will not address the learning outcomes and will not lead to a good mark. They are also reminded of the danger that the presentation might unduly distract from the two other elements of assessment, and the need for rigid time management throughout the project.

In the week before the oral presentation assessments take place, we arrange peer review sessions in which

students can present to fellow communication project students, as well as those undertaking other project types and students from other disciplines across the university. These sessions in particular are very much appreciated by the students as it gives confidence in presenting skills as well as support and guidance from a friendly and non-judgemental audience.

Presentations

We hold our oral presentations approximately 9-10 weeks into the project term to coincide with National Science Week (typically mid-March). Presentations are delivered in local schools to classes of students ranging from 14-18 years old. Schools are a convenient outlet for the oral presentations as they can provide a ready-made audience relatively easily; furthermore, they represent an important audience for the University in terms of outreach. We have our own contacts in schools, but also work with the University Partnership Development Office responsible for promoting widening participation which has strong links with target schools. Thus the presentations are undertaken in a range of environments, from selective grammar schools to those who do not traditionally send students to university. Students speak for 15-20 minutes, with the aid of PowerPoint and any appropriate props, after which the audience asks questions. Typically two presentations are undertaken within a 1 hour lesson, and the teacher acts as a co-assessor of each speaker.

Advice on using this approach

In designing communication projects, we were aware that external examiners would be interested in ensuring parity with other project types. It is therefore important to have an element of the project that ensures students are assessed on their ability to undertake in-depth research. The dissertation addresses this need and is designed so that students have to engage with research literature in the same way as other project students. It also prevents the perception from students and staff that a communication project might be an easier option than, for instance, a laboratory project.

The initial approach to schools can be time consuming and the teachers themselves are driven by their own timetable and learning agenda. They sometimes need convincing of the value of setting aside valuable lesson time to allow our students to speak to present their work to the class. However, once they have participated they are usually very willing to host the presentations again as it provides clear added value to their own pupils' learning experience.

As a safeguard against the negative impact of uncommitted students being given a platform in the schools, we have had to develop an 'in house' assessment strategy for the presentations, undertaken by two members of academic staff. Students are monitored by supervisors during the project and a decision as to whether students give their presentations in house is taken a week prior to the school visits.

Troubleshooting

There is a danger the communication piece using a different form of media than the oral presentation, can become an afterthought and does not get the attention it warrants. This is often where students lose sight of the learning outcomes and the fact the piece must contain scientific information that is 'translated' to make it more engaging and understandable to non-scientists. We are working to try to resolve this issue by providing suitable advice and guidance, but may ultimately need to resort to having more rigid guidelines relating to the use of a single type of media (for example, a magazine article) rather than allowing students to have more free rein in their choice of media; we have received posters, CD-ROM material, websites and even T-shirts for this part of the assessment, with mixed success in terms of marks awarded to the students.

Does it work?

Minor problems aside, we think it works on a number of levels. On a purely departmental level, it is logistically very difficult to accommodate increasing student numbers in laboratory-based projects. The communication projects have relieved a great deal of pressure by providing an attractive alternative that offers an equal learning experience to students but which places less demands on departmental infrastructure.

For the students that participate, the projects provide an outlet for developing skills that are useful in a variety of professional settings and opens doors to a range of careers that would otherwise be difficult to gain access to. For this reason, it has attracted students with diverse experience; those who do not wish to work in a laboratory after graduation, those who have previously undertaken laboratory research during a sandwich year or vacation placement; and those who aim for careers that have less to do with science but a lot to do with communication. A number of students have indicated how formative the communication projects have been in developing exciting careers. Feedback from the students

has been overwhelmingly positive, and they clearly gain a lot from presenting their work to an unknown and potentially intimidating audience.

The response from both school pupils and teachers is similarly positive. It allows the teachers to extend their pupils' knowledge and aspirations without spending a great deal of time researching new topics beyond the national curriculum. Exposure of pupils to university students is a particularly powerful element of the scheme, since the majority of students presenting are only a few years older than the school pupils. The fact they appear so well-informed and engaging is clearly inspiring to the pupils, and is particularly so in the schools with low progression rates to higher education. There is usually an opportunity after the presentations for the students to mix with the pupils and talk more informally about life at university, studying science, etc.

Further developments

We have extended the scheme so the students have other opportunities to present their talks. After end of year examinations some students present their talks again at a public showcase event, which has become a fixture of the university calendar. We work closely with the Partnership Development Office to identify opportunities for our students to represent the university, within schools and colleges, local community groups and adult education networks. These offer paid working opportunities to our students and additional experience for presenting to diverse audiences.

We have also obtained funding to pay students over the summer vacation to generate 'teacher resource packs'. These packs link the content of their projects to elements of the national curriculum and provide teachers with PowerPoint presentations, question sheets, practical exercises, lesson plans and reading material. The hope is that this will allow teachers to deliver inspiring, cutting edge scientific research in schools to illustrate core elements of the national curriculum, without having to undertake extensive preparation. The first Resource Pack has been prepared and we are hoping several students will participate each year.

We are setting up an MSc in 'Science, Communication and Society'.

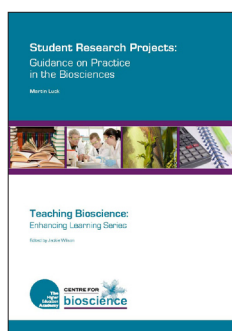
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Accompanying materials

This case study was written to accompany the Teaching Bioscience: Enhancing Learning guide entitled *Student Research Projects: Guidance on Practice in the Biosciences*, written by Martin Luck and published by the Centre for Bioscience. The associated website (www.bioscience.heacademy.ac.uk/resources/TeachingGuides/) contains a downloadable version of this case study and the following additional material:

- Guidelines and mark scheme for communication projects.



Case Study published October 2008



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