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[O22] Involving undergraduates in outreach and public engagement through final year projects in science communication

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Abstract

Public engagement is an increasingly important issue in the sciences. With such rapid developments in science and technology, effective communication regarding the benefits and risks of scientific progress has never been more important. In the Department of Biosciences at the University of Kent, we have introduced science communication activities to the undergraduate curriculum as part of the final year research project. 'Communication Projects' were introduced in 2005 to complement our existing portfolio of final year project types. Students undertaking Communication Projects complete an extended period of in-depth literature-based research on a topical, controversial or poorly-understood area of science (examples have include the use of stem cells in medical research, the use of performance enhancing drugs in sport, and the risks of biological warfare), and then develop strategies for communicating the research to a non-scientific audience. Thus, the students write an extended dissertation on the outcomes of their research, and also prepare an oral presentation and associated materials in which the research is explained in a manner that is accessible to non-scientists. The oral presentations are delivered and assessed during National Science Week in local schools to students of mixed ability and age, and are repeated at public showcase events later in the academic year. These presentations are becoming an important addition to departmental outreach activities, and we are increasingly targeting schools with low participation rates in higher education and science subjects post-GCSE. The positive outcomes for final year students, teachers, school pupils and the university will be discussed.

Introduction

The ability to communicate science is an important skill among science graduates. At a time of rapid progress in medicine, biological and physical sciences, engineering and technology, effective communication is essential to encourage people to engage with science, understand the benefits and risks of scientific developments and form their own opinions about science and its place in a modern society. Ineffective communication can lead to misreporting in the media and inaccurate representation of the implications of scientific developments. Perhaps most damagingly, lack of public engagement leads to general disinterest in science and technology. Furthermore, the decline in studying science subjects in post-16 education, and consequent shortage of science graduates and science teachers, is leading to concerns for the sustainability of science and technology in the UK.

Several recent initiatives, implemented throughout the scientific community, aim to address this at a national level. There are significant developments in secondary science education with new A2- and AS-level courses that focus on ethical discussions on the impact that science has on society, while Research Councils, charities and industry all provide funding for scientists to engage with the public. However, while these schemes help those who already engage in science communication activities to do more, the root of the problem may well be that scientists do not consider public engagement to be an inherent part of their role in society, and regard any time spend communicating science to the public as a barrier to their research. The philosophy I outline in this paper is that we need to train undergraduates to recognise that communication of their subject and engagement with a non-specialist audience is an integral part of their role. This would provide a large number of science graduates with skills in explaining scientific issues, both in a formal and informal capacity, in an engaging and inspiring way, thus promoting public understanding of science and leading to a population empowered by knowledge and inspired by science and technology. The challenge, however, is to fit training in science communication into a practically-based curriculum with competing priorities and a very busy timetable for students and staff.

Final year 'science communication' projects

This paper describes the development of final year 'Science Communication' projects, an addition to the final year project portfolio in the Department of Biosciences at the University of Kent. Communication projects are undertaken on a topical or controversial area of science such as cloning, bird flu the use of stem cells in medical research. Students undertake an extended period of research, leading to the preparation of a **dissertation** in which the student reviews, in depth, the scientific literature and focuses on modern developments within that field. This ensures that students achieve appropriate depth and comparability with students undertaking other types of final year project (e.g. laboratory-based or dissertation projects). For example, in a recent communication project concerning the use of performance-enhancing drugs in sport, the student undertook an in-depth literature review on the cellular effects of drugs that are banned by the world anti-doping authority (e.g. anabolic steroids and erythropoietin), focussing in particular on how the complex cellular signalling initiated by these drugs related to changes in physiology that would be beneficial to particular sports.

Having undertaken in-depth scientific research as part of the dissertation, the students are in a position to develop strategies to *communicate* what they have learned about the science to an audience that does not necessarily have any scientific training. The 'communication' element of the project involves the preparation of an **oral presentation**, together with supplementary material such as an interactive website/CD-ROM or even a magazine article, *all intended for a non-scientific audience*. This allows the students to think in a way that they probably have not done during their University careers in order to develop strategies for explaining the science behind their project. The presentations must not be a superficial treatment of the underlying scientific principles; 'skimming the surface' of the subject is not sufficient. Indeed, the preparation of a dissertation based on in-depth research informs and underpins the presentation, ensuring that the content is cutting-edge. Thus, the student undertaking the communication project of performance enhancing drugs explained the cellular signalling described in the dissertation, and related this to ethical, medical, social and political considerations of the use of drugs in sport, in a way that could be understood by a group of AVCE Sports and Recreation pupils in a local school.

Communication project presentations take place in local schools during **National Science Week** in mid-March. The audience comprises pupils in years 10-13, studying a mixture of subjects. We work with a range of schools, including those with low participation in higher education and post-GCSE science, and the teachers within the schools act as co-assessors of the 15-minute presentations and students' fielding of questions.

Support and guidance

Communication projects are undertaken with the guidance of an academic member of staff, with whom students can discuss their ideas and obtain relevant information. The supervisor may well be an experienced scientist and teacher and will certainly be able to offer research guidance, but is not necessarily an expert in the specific area of research; thus, the supervisor and student are true partners in learning. Academic staff produce an exciting array of topics for students to choose from each year; some of these are topics that are very much in the public arena but warrant further discussion (e.g. the use of stem cells in medical research, the risk of biological warfare post-9/11), while others have been more esoteric but no less interesting or controversial (the evidence for a gene for homosexuality, the use of homoeopathic medicine, the benefits and risks of the Atkins Diet).

As the date of the assessed presentation approaches, group workshops are arranged in order to encourage students to think about what constitute good and bad presentation skills. The students work in small groups to critically analyse their own learning experiences, and to formulate their own 'checklist' of good and bad practice to use in preparing their presentations. Peer review sessions, in which the students present their talks to each other in a supportive environment, are also organised so that speakers can obtain guidance from their peers before the assessed presentation. Feedback has indicated that this helps to prepare the students for the daunting experience of giving a 20-minute talk to a diverse and unknown audience, and it clearly increases the standard of the presentations.

Evaluation and outcomes

Now in their third year of operation, communication projects are firmly embedded within the undergraduate Bioscience curriculum at Kent, with approximately a quarter of our final year students electing to undertake them. It is recognised by the students that the extended period in which they engage in research and effective dissemination provides them with very valuable skills for future careers. Communication projects also provide us with a formal mechanism to reward students who possess skills in engaging and stimulating a broad audience and increasing interest in science. It is clear that students who do not necessarily have the highest academic abilities can be natural, engaging and imaginative communicators. Furthermore, the preparation of a presentation enhances the understanding of the student's research topic encouraging a 'deep' rather than 'surface' approach to learning. Student evaluation has been very positive; indeed, one student was moved to write *'throughout the course of the project, I learned the important value of tailoring scientific communication for different audiences, which has given me a distinct advantage in my new job as the Commissioning Editor of two new and exciting scientific journals. I honestly don't think I would have done as well at Kent, or have this career, without the communication project'*. The projects have also been embraced by staff within the Department; all academic staff have now supervised at least one communication project student. In many cases, supervision of communication projects has inspired staff to

increase their own involvement in outreach activities, and as a department we are now more aware of the importance of public engagement. External examiners have also praised the scheme as an effective way of integrating scientific depth and rigor with a training in science communication.

The integration of Biosciences students with the local community has also had a major role in raising the profile of the department. The school pupils and their teachers collectively benefit from the content of the student presentations, which is not usually covered within the rigid confines of the exam board curriculum. Such is the enthusiasm of the participating schools for the scheme that two of our partner schools have block-booked a whole day of the timetable for the student presentations. In selecting the schools in which to deliver talks, we work closely with the University's Partnership Development Office to target regional schools that currently have low participation in science subjects post-GCSE, and indeed the Higher Education sector in general. This year, communication project students will also present their work to local community groups and adult learners after end of year exams, and have a further opportunity to present at the 'Biosciences Communication Showcase', an open event to which schools, colleges and the local community are invited. These activities collectively generate significant local and regional media attention, raising the profile of the department, the University, and the student presenters. While it is too early to say whether the scheme has had a significant impact on UCAS applications, the increased local profile is having a very positive influence in the way we are perceived.

Another very positive which illustrates the impact that the Communication projects have had on students is *Student Science News* (<http://www.kent.ac.uk/bio/study/Outreach/Default.htm>), a newsletter covering topical scientific issues aimed at the 14-18 year old age group. It was founded by communication project students and is written, edited and published by them, all on a voluntary basis. The content of the newsletter includes topical scientific stories in the news, Kent-based research and 'fun' scientific facts in an exciting and accessible format. Five issues have been published, each of which had a print run of 6,000, circulated to almost 100 schools in the South East. A new editorial team is assembled each year, and this year the team includes students undertaking laboratory-based projects; the idea that science needs to be communicated effectively is also clearly being taken seriously by those who aspire to laboratory-based research careers. The newsletter also gives students ownership of a prestigious and high quality publication, and has certainly been an important addition to the CV of those involved over and above the effect it has had on their learning experience.

Ultimately, our aim is to train graduating students to recognise the importance of communicating science and public engagement. We hope that, as communication projects develop in future years, a tangible change in culture will continue to emerge in which public engagement is regarded by undergraduates as a worthwhile, valuable and enjoyable activity.