

Final Year Education Projects

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Background and rationale

Final year Education projects in The Faculty of Life Sciences at The University of Manchester are an alternative to traditional 'wet' laboratory projects and take place from January to April in the students' final semester. They are undertaken by approximately 20 students each year; appealing especially to students who are interested in studying for a PGCE after graduation, with a general interest in pedagogy, or to students who are enthusiastic about interacting with people outside a laboratory setting. The projects encourage effective communication of science; a skill that is extremely important for scientists (Lloyd, 2006). These projects are also welcomed by Faculty staff who are under pressure to provide laboratory space for an ever-increasing number of undergraduate students. In addition, Research Council-funded scientists are actively encouraged to assist and support involvement with local schools as well as promote science understanding in local communities (BBSRC, 2008), a requirement that can be fulfilled by Education projects.

The intended learning outcomes (ILOs) for the projects are to:

- Engage in independent and normally original research or use scientific knowledge to develop a product (e.g. a school practical, a workshop or revision aid) which may be of value in teaching and learning.
- Gain experience in scientific techniques appropriate to the investigation
- Gain experience in data analysis
- Gain experience in the skills of relating your own research to that in the existing literature
- Gain experience in the communication of scientific results.

How to do it

Prior to starting the project, students submit a literature review (worth 10 credits) at the end of the preceding semester (in December), which allows the student to engage with the biological research literature in a topic appropriate to the project.

Education projects are varied but are generally of two types: i) where the student has to design and deliver a lesson or workshop for schools, undergraduate students or to the public; ii) the design of a learning resource/educational product for undergraduate or school students including activities, games or revision aids.

An example of project type i):

A plant science activity day For Balderstone Technical College: a Year 7 (age 11-12) class at Manchester University.

This project involved designing a Science Day, taking in a half-day visit to the University Experimental Botanical Grounds and a practical class in University laboratories.

Project student input:

- Liaison with school to agree an area of interest for a Science Day event. Investigation of the National Curriculum to determine syllabus and potential for topic expansion.
- Design and planning a laboratory practical class suitable for 60 Year 7 pupils, including full teacher instructions. The topic chosen was the investigation of chlorophyll and photosynthetic pigments, which was explored in greater detail in the literature review.
- Design of activities at the University Experimental Botanical Grounds. This included developing a supervised tour of the different greenhouses with pupil worksheets designed to stimulate interest in the different plants & their environmental adaptations.
- Overall responsibility for the timetabling of the Science Day and liaison with school, including letters of invitation.
- Project management and delivery of the Science Day. This included organising the visit to the Botanical Grounds, a fun quiz for the pupils, running the practical class and evaluating the event using pupil, demonstrator and teacher questionnaires.
- Analysis of the evaluation of the Science Day using the results of the questionnaires.

An example of project type ii):

The design and evaluation of activities to enhance problem-based learning for first year dental students.

During the semester, as part of their problem-based learning course, dental students are given different activities to complete based on subject material covered during periods of self-study. The activities are varied and intended to promote problem-solving and team-working skills, as well as help determine gaps in subject knowledge that may require further study.

This project involved designing and evaluating several new activities for potential future use.

Project student input:

- Research the types of 'active learning' exercises currently used in other teaching situations.
- Exploration of the dental curriculum and determination of which topics could be developed into an active learning session.
- Design and development of several teaching activities, including explicit intended learning outcomes, detailed tutor notes, compilation of resources needed and detailed marking schemes.
- Design of an evaluation procedure to determine the 'success' of the project, including defining criteria for 'success'.
- Performing and analysing the evaluation.

In order to facilitate the educational project, liaison with a local school is often necessary. In our Faculty, such liaisons are organised by our outreach officer, the students themselves through a personal contact, or can be through the supervisor. In the past, one-off events have also been arranged at the Manchester Museum (www.museum.manchester.ac.uk/) to coincide with national initiatives such as National Science and Engineering Week (www.the-ba.net/the-ba/Events/NSEW/4).

The type of educational resource (e.g. a workshop), or the specific context of the resource required (e.g. to support a particular undergraduate unit) may already have been determined by the supervisor; hence the student starts the project with an outline of the resource from the outset. In other situations, the student may need to liaise with schoolteachers to determine what is required and thus the 'needs analysis' may form part of the project itself.

The next step is the research, design and development of the actual resource. This may include varied activities such as compilation of materials, lesson planning, costings, supporting tutor notes, booking coaches and venues, or actual organisation and delivery of the lesson/workshop. The resource will also be evaluated using methods determined by

the student as appropriate. This may include questionnaires to determine student or tutor perceptions of the resource (qualitative evaluation) and/or a measure of how effective the resource is in achieving its intended learning outcomes (quantitative evaluation).

Assessment of Education projects has 3 components:

- 20% for project performance (awarded by the supervisor)
- 20% for the resource (marked by the supervisor, and anonymously blind-marked by another academic)
- 60% for the project report (marked by the supervisor and anonymously blind-marked by another academic)

The project report counts for the majority of marks and is analogous to the report submitted for laboratory projects. Specific details of what should be included in the report can be found on the website which accompanies this Guide (www.bioscience.heacademy.ac.uk/TeachingGuides).

Marking guidelines and assessment criteria match other final year projects available in our Faculty. The Literature Review submitted in December is worth 10 credits and the project itself counts for a further 30 credits, equating to around 300 hours work.

Troubleshooting

Education projects have been erroneously thought of as 'soft options' for students incapable or reluctant to undertake what they perceive to be a more rigorous laboratory project. However, Education projects need to be planned and time-managed effectively, with sufficient time allowed for the evaluation of the resource in addition to the actual product development; indeed this evaluation is an integral part of the final report. The onus of project management lies squarely with the student, and thus Education projects suit individuals that are self-motivated and capable of working independently. In order to credit students who produce quality resources, the assessment criteria include a separate mark for the educational product as well as one for the report itself. In this way, any student that does not work productively through the semester, or who produces a product of little utility will not be able to achieve a high mark.

Education projects have in the past been criticised internally by some members of staff in our Faculty for not engaging with biological science at a tertiary level. However, this has been addressed by the requirement for a literature report (based on primary research literature) to be submitted prior to starting the project, and by encouraging the inclusion of full explanatory tutor notes to accompany the resource

where appropriate. Indeed, often to present and develop topics successfully at a lower level, the author needs to be fully cognisant of the subject matter at a higher level of understanding.

Does it work?

Education projects are extremely cost-effective for the Faculty to run as they incur minimal overheads per student. They have been undertaken in some guise in our Faculty for >15 years, and have gained approval from external examiners as providing an adequate training in scientific methods such as experimental design, data evaluation and communication of science. The projects emphasise directly the link between research and teaching, showing how complex ideas often have to be distilled to be appreciated by younger or less knowledgeable audiences, without diluting the essential scientific principles. The process of designing & delivering teaching materials helps students consolidate their own learning and understanding, as they are required to ensure they are comfortable with different aspects of the topic, in order to communicate effectively to other students.

The distribution of marks and degree classifications awarded to Education projects has been similar to those of laboratory-based projects. Anecdotal evidence from former students has shown that they have found Education projects to be enjoyable, although challenging, and provide valuable transferable skills. Feedback from schools involved with Education projects is invariably excellent, as the projects allow difficult or recent scientific advances to be communicated to their students in novel and interesting ways. The school is then left with a tried and tested educational resource that can be used in future years.

Further developments

Students are 'trained' to perform and report traditional laboratory-type projects from the beginning of their scientific studies. However, students are given little training in how to proceed with education projects, and these often involve unfamiliar techniques such as evaluation via questionnaires and engagement with educational literature. From next year, we will offer a series of seminars to support the students through the semester in preparation for carrying out the project. Topics to be covered will include: learning styles, accessing the educational literature, study design, project management, questionnaire design, evaluation and assessment of the projects.

Anecdotal evidence suggests that many academic staff are uncomfortable with supervising these types of projects,

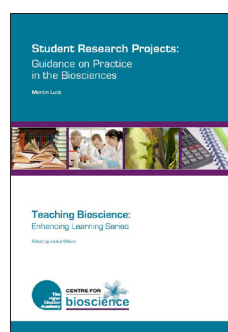
and feel they do not have the background experience necessary to give appropriate guidance to students. Thus in future, supervisors will also be invited to participate in these seminars with a view to developing a 'supervisor training session'. This hopefully will encourage more supervisors to offer these types of projects, and to feel supported when doing so.

References

Lloyd D. (2006) Final-Year Projects In Science Communication. Centre for Bioscience Bulletin 18:11 Available at www.bioscience.heacademy.ac.uk/ftp/newsletters/bulletin18.pdf (Accessed April 2008)

BBSRC Science in Society: www.bbsrc.ac.uk/society/index.html (Accessed July 2008)

Additional materials



This case study was written to accompany the Teaching Bioscience: Enhancing Learning 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:

- A description of the report requirements for Education projects
- Assessment criteria used in determining project performance and for assessing the educational resource.

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