

Preparing students for research: teaching research skills at level 2

S.N. Davies and M.A. Cotter, College of Life Sciences and Medicine, University of Aberdeen, AB25 2ZD
E-mail: m.cotter@abdn.ac.uk

Background and rationale

Bioscientists are well aware of the importance of the final Honours project as the highlight of a student's time at university. Many students carry out original research which becomes a part of work published in the discipline's peer-reviewed literature. We were interested in how students can be better prepared for their Honours project work in a more structured way. For several years our Level 1 MBChB (Medical) students have carried out research projects as part of 'Student Selected Modules', designed to give them experience of the evidence-base of medical practice. These have always been very successful and popular with students and staff alike. We decided to introduce this concept as a Level 2 science course (the standard period for an undergraduate degree in Scotland is four years) to enable our bioscience students to develop the essential skills needed to undertake a research project. The course was introduced in 2006/07 and was taken by approximately 180 students. The course carries 15 credits and is a compulsory component of the four courses students take in the second semester of second year in the School of Medical Sciences (the School has introduced further research-based teaching for Level 3 students to build on the Level 2 course and enhance the development of the necessary skills for their Honours projects in fourth year). Students work in groups and plan and conduct desk-based research (i.e researching and reviewing information) into the theoretical basis of topics relating to the broad theme of Health and Disease; they present their findings orally and in an essay written under exam conditions. To facilitate the course, second year science teaching was restructured to enable a three hour block to be freed up when all students in the School would be able to participate. (We use Wednesday mornings, which enables us to use teaching labs with very good computer access and good learning space for small group work.)

Learning Outcomes

- To carry out work in a disciplined manner as part of a team.
- To take responsibility for ensuring the group deliver the research project.

- To understand how to use library facilities to perform a basic literature search and assemble relevant information.
- To understand the basis of scientific investigation and the importance of hypothesis driven enquiry.
- To understand the importance of critical appraisal of information sources and the reality of conflicting views on important research topics.
- To explain and educate your peers on information you have learned about the group topic.
- To demonstrate basic computing and communication skills to create an oral presentation.
- To answer questions on any aspect of the project following the oral presentation.
- To contribute to the discussion on the oral presentations of other groups in your theme.
- To understand the meaning of plagiarism and take responsibility for ensuring that the group's project is a true reflection of the group's own work.
- To demonstrate the skills needed to write an individual report of the project under exam conditions.
- To develop transferable skills related to teamwork, time management, communication and information technology.

How to do it

- Students work in small groups to research a topic related to Health and Disease. They then prepare a research report for oral and written presentation. A list of topics, grouped into themes, studied in 2007-8 is available to download from the associated website.

- In the first semester of second year, students are given an information sheet outlining the course so they are aware of what is involved. At the start of the course, students attend a lecture session where they are given an overview of the course and a summary of the topics available for the research project.
- Students then move to teaching labs where they are able to find out more about the topics from the theme leaders and can get together into small groups. A group of 6 students is ideal, but we let them form groups between four and seven rather than force them into unhappy alliances. We have 6 or 7 themes depending on student preference and a number of very senior, experienced staff help to sort out the student topics into cognate groups to ensure lively discussion at the presentations.
- Students then exchange details and agree methods of communication between their group and tutor, and start to plan how they are going to tackle the project.
- Milestones of achievement are set. For example, on or about a specific date students must present their tutor with an overall plan specifying individual responsibilities for researching and preparing each section of the project.
- After five weeks, students meet their tutor for a session when all members of the group are expected to demonstrate understanding of all the material in the project.
- Email is the mode of communication with the tutor, the theme leader, the course organiser and course administrator. Each group appoints a secretary, responsible for co-ordination of information and communication about the group's progress and a treasurer who receives a small budget to cover costs involved in the project, usually printing costs.
- Each group also nominates a representative who attends a seminar run by the Library where they receive advice and help for finding out how best to use literature searches. This student is then responsible for disseminating the information to the other members of their group.
- Students then have seven weeks to prepare a joint project, which they present as an oral presentation (using PowerPoint) to the other members of their theme. Thus presentations will be to between 20-36 students and 4 to 6 members of staff. In addition they write an individual summary of the project under exam conditions in the ninth week of the course. The time allowed for this is 1 hour (with additional time for students identified by Student Support Services as needing more time). An additional slot is available in the following week to cover students with medical or good cause reasons, who were unable to do the exam component the previous week.
- One of the most important aspects of the project is that members of the group explain and inform the rest of the group about the section of the project they have been responsible for investigating. In the question session following the oral presentation, every member of the group is expected to answer questions on any aspect of the project. So the expectation is they will all have an understanding of the project in its entirety.
- Over the seven week period up to the presentation students have meetings with a tutor/ facilitator, whose primary job is to ensure the group are working productively and they are achieving identified milestones. It is the students who ask to meet with the tutors if they want to.
- The students are told it is their responsibility to manage the project and deliver the oral presentation and individual essays.
- Since many students are involved in sports on Wednesday, we also offer a 3 hour slot on Fridays so the students have somewhere to work together and have access to a computer.
- Help sessions are offered for students wanting training in PowerPoint.
- Putting the oral presentation together is the responsibility of all members of the group, although it is up to them to decide how to present it, e.g. some members make take responsibility for preparing the PowerPoint slides and others actually give the oral presentation.
- Oral presentations are arranged so that the (normally) 4 groups of the theme present their topics in the same session to encourage lively discussion. The talks are supposed to last 20 minutes and there are 10 minutes of questions. All students are expected to answer questions on their own project and to ask questions of the other groups about their presentations.

Outline of the project

The projects relate to the overall theme of "Health and Disease". A number of sub-themes will be studied, each with a number of topics, giving 4 groups of students studying a different topic within each sub-theme. The sub-themes are listed below:

- Genetic diseases
- Auto-immune diseases
- Developmental diseases
- Microbial diseases
- Diseases affecting the Nervous System
- Acquired diseases
- Exercise is the best Medicine

Mostly students are looking at a specific disease entity and then finding out about the following key areas which form the common structure for all the projects.

- Relevance of the disease or condition. How common is it, who does it affect?
- What are its causes e.g. are they genetic, autoimmune, viral, lifestyle-induced? Or indeed all of the above?
- How does the disease affect normal biochemistry and physiology, or structure? (Clearly need to understand normality first).
- How is the disease treated? What is the rationale for the treatment?
- Are there any exciting new therapeutic strategies that might be used in the future?

Within this overall structure, different topics will have different emphases.

Advice on using this approach

Be brave. We have found that if you challenge the students and provide the framework, they will rise to the challenge really well and deliver an excellent outcome. Make sure that the students are investigating a subject they are really interested in. Give them lots of choices and let them suggest their own topics. On the second run of the course, we were very "hands-off", so that the Exercise theme had 7 topics and the Microbial diseases became part of Acquired diseases. Now that we are very happy with the outcome of the course, following its second run, we are very open to students deciding what the topics should be and so arranging the topics and themes very flexibly.

Have enthusiastic and flexible tutors who are able to respond to student needs. We use between 32-36 academic staff and make sure you have a really good course administrator.

Troubleshooting

The only problems we have encountered are those related to all small group work, i.e. some groups have an unproductive dynamic and may need more intervention by tutors, theme leaders or course co-ordinator. This however has been a small problem, so far only a maximum of 2 groups out of 36. We stress the importance of learning to negotiate their way out of tricky situations and see this as a valuable learning experience.

One of the issues that contribute to a poor group dynamic is late-registration of students for the course. There is resentment at putting a late registering student into a group that is already up and running so we have tended to put the "late-starts" together in a group with a very experienced tutor. These are the groups that tend to have difficulties.

Does it work?

Overwhelmingly the course works, in terms of student enthusiasm for the project, the standard of their presentations, the quality of their project write-ups. Students enjoy the autonomy and responsibility.

The course is very flexible to deliver. There is only one hard milestone which is the week 7 presentation. The tutorial, scheduled for week 5 and the exam scheduled for week 9 can both be re-scheduled to suit the needs of the students. Delivery of the endpoints is the responsibility of the students.

The course enhances their academic and transferable skills. Since they have to understand normal structure and function in order to understand disease, we have found they have enhanced comprehension of the material in their parallel courses. A key component of this is the need to explain and teach their peers in the material they have researched.

Evidence it works

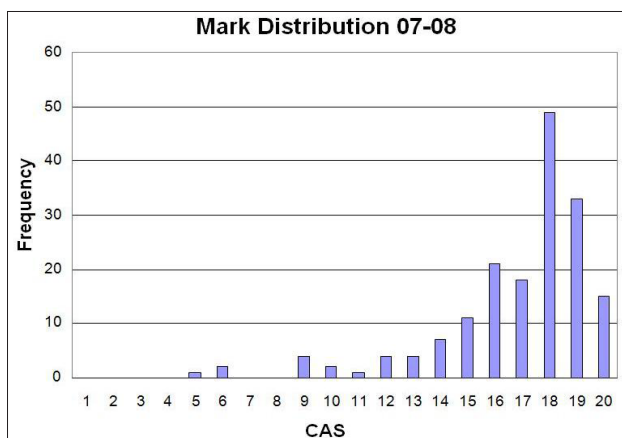
Students fill out Course Evaluation forms, which have a section tailored to a particular course. Below is a summary of their responses to the first run of Research Skills for Life Sciences, in which their approval; Agree/Strongly agree ratings have been summarised together with their unfavourable responses; Disagree/Strongly disagree. Responses that are Neither agree/Nor disagree are not included.

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Statement	Agree / Strongly Agree	Disagree / Strongly Disagree
The course has challenged me	78%	4%
The course has increased my interest in the subject	75%	5%
The course has increased my understanding in my subject	75%	2%
The course has helped me become a more independent learner	74%	6%
The course has helped me develop my group working skills	79%	3%
The course has helped me develop my presentation skills	78%	4%
I feel more confident about undertaking new assignments	74%	2%
I would perform a similar project better in the future	79%	2%
I have enjoyed this course	65%	6%

In terms of the assessment for the course, the marking scheme is shown below together with the distribution of final marks for the 07-08 cohort of students. The University uses a Common Assessment Scale, where e.g. 15,16,17 represent upper second marks and 18,19,20, first class marks.



The marks were very good, and this is a common finding where small group work that is well done tends to pull all the students up to a higher level (marks at Level 2 do not contribute to the final degree classification).

Assessment

- Group Presentation: 30% Tutors of Theme, 10% Other groups in Theme
- Course Performance: 15% Tutor (Including

Tutorial 10%), 5% Peer group

- Individual Essay: 40% Tutor (moderated by Theme leader and course organiser)

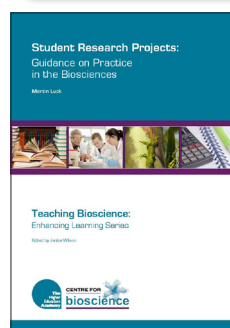
The resit exam consists of an oral presentation to staff and submission of an entire project report under exam conditions, i.e. have to do it all on their own.

Further developments

The second run of the course has gone very well. Now we know it works, we have become much more "hands-off" and given the students even more autonomy and responsibility. This approach has been very successful. Students this year have made their presentations even more imaginative, e.g. presenting the topic in the form of a play. We have similar experience with the medical students, where they have made very professional videos and performed plays.

We really are seeing that by giving the responsibility to students and demonstrating our belief in their abilities, they are really responding extremely well and becoming truly autonomous and confident learners.

Accompanying materials



This case study accompanies 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 and other case studies and the following additional material:

- Essay marking sheet
- Oral presentation marking sheet
- Summary of research topics
- Module information for students
- Group performance marking sheet

Case Study published October 2008

