

Student Centered Education

A Sample Practical Report to Facilitate Writing in the Scientific Style[§]

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The ability to write concise and accurate scientific reports is highly valued in university level science. The graduate outcomes for bioscience degrees in England include a requirement for students to be able to analyze, critique, present, and discuss original data in their discipline [1] as these are a key part of the skills a professional bioscientist needs. This is consistent with the wide use of “final year projects,” where many finish their degree by taking on their own project, analyzing their own data, and presenting the results in a report [2]. Before final projects, practical work and its reporting are also an essential part of the undergraduate student experience. In theory, this practical work should enable students to build up their experimental and report writing skills in preparation for the final year. However, despite many study skills books covering scientific writing, it is acknowledged that this is something science students often struggle with [3, 4]. This is illustrated through the variety of approaches taken to address this in the literature, including mini research projects or study skills courses [5, 6]. Although some now question whether the scientific report is a sustainable form of assessment with increasing class sizes [7], most still consider it vital for helping students learn about research and report writing.

From reflection on marking student final year reports, it was apparent that many of our students have had insufficient practice at writing complete “scientific paper” style reports by that time, although some do it very well. This is a previously identified problem for undergraduates writing reports, even though there are detailed guidelines, as the format and style expected at university is quite different to that used at school [8]. The more students are embedded in the discipline and reading original literature, the easier it is for them to pick up writing conventions and good ways of presenting data, or even actively deduce conventions from reports [9]. First-year students usually lack sufficient knowledge of biochemical methods to read journal articles well [7], so a different approach is required. The use of exemplars for communicating the

style and level of work required is common practice [10], is observed to be favored by students [10, 11], and would seem to be an obvious choice. However, as the subject of practical report are the same every year, teachers are reluctant to share previous student work or provide “model answers” as they do not want to tempt students to plagiarize them. Therefore, a resource was created that modeled a practical report on a topic different to that of the practicals. This approach has also been used to address this problem of scientific report writing in related fields [12].

CREATING THE RESOURCE

To clarify the guidelines for writing practical reports, a sample report was designed which incorporated guidelines linked to the text. The report was eight pages with each page consisting of 2/3 “report” and 1/3 notes to illustrate the text. The notes illustrated examples of style and formatting that are used in reports as well as comments on the contents of each section. The notes, the topics for which are summarized in Table I, were similar to the guidelines already provided on how to write reports. The choice of topic was based on the data the author had to hand for an experiment that did not work, to show that good writing does not depend on “correct” results.

INITIAL EVALUATION OF THE RESOURCE

A pilot evaluation was carried out with small groups of staff and students. Student opinions were sought to find out if they understood the resource and staff opinions were necessary to check that they agreed that this resource embodied good report writing.

Student Opinions

Opinions from a small group of students in each year were sought using either a short survey, for first and second years, or a focus group for final years. The advantage of running a focus group with the final years was that it also allowed for a discussion of the students experiences of practicals and writing reports. All the responses to the resource were overwhelmingly positive,

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TABLE I
Aspects illustrated by the practical writing resource

Section	Topics illustrated and commented on
Introduction	Outline of an introduction structure, going from broad to specific How to include references in the text for books and journals How to abbreviate How to refer to and include figures and panel figures Referencing of figures
Methods	How to write aims in the past tense How to write in the past passive tense How to combine variations on a method within one description Use of subheadings Relevant details The importance of concentrations, units, timings, etc.
Results	How to introduce results and state the aim of experiments Use of the past tense Describing what the results show Logical, rather than chronological, ordering Careful choice of descriptive language Layout and labeling of graphs and gels Use of figure titles and examples of figure legends
Discussion	Suggestions for the scope of the discussion, with warning to focus on the outcomes desired by the teacher for each practical Examples of discussing meaning and relating results to aims and the literature Examples of how to comment on future work or method improvement
References	Format for referencing journals, books and websites Notes on referring to library referencing guidelines Comment on the relative merits of types of literature

with the final years being particularly impressed as they could see how it encompassed what they had been learning throughout their degree. The side by side format with the matching of the guidelines to an example was seen as useful. Although final years were united in the opinion that the resource should be useful for all levels, some first and second years thought the topic might be too complex for the beginning of the programme, unless discussed in tutorials.

Teacher Opinion

The resource was discussed by the teaching committee as part of the annual review and received several positive comments. It was noted that this would contribute to the new approach we are developing of providing model answers. Due to the diverse nature of tutorials within the department, it was thought that it would be tricky to introduce the resource this way, and an introductory lecture was suggested instead.

IMPLEMENTATION AND FURTHER EVALUATION OF THE RESOURCE

The resource was made available to all students through the department virtual learning environment. Unfortunately, due to the layout of the environment, it

was difficult to find a prominent position for it. To raise awareness of the resource and to help explain it, an introductory lecture to first years was arranged. The lecture included the concept of university practical reports, how to find the resource, a brief introduction to the topic the resource was based on and a review of the sections in the resource, indicating the role of each section in telling the story of the report.

To evaluate the uptake and usefulness of the resource, first years were surveyed anonymously during a lecture later in the year. The questionnaire was short, asking if they had used the resource, and if so, what was good and could be improved. If they had not, they were asked why not. The questionnaire was kept simple due to the time constraints of the setting. The idea was to find out if the students had found the resource useful, rather than to evaluate parts of it in detail. A total of 49 out of 78 first years, those who were present in the lecture, completed the questionnaire. Of these, 31 (63%) had used the resource when writing practical reports. Students commented that they found the resource useful for understanding the layout, knowing what to include in each section, formatting figures, and style of writing. Some of the students also commented that having the links between the notes and the example was good, and that this was particularly helpful as it was different to what they had done at school. Of those who had not used it, the main reason (39%) was that they were unaware of it, presumably because they had missed the initial lecture. Other reasons included “could not be bothered” and “could not find it.” Three students (out of 18) commented that they found it hard to use either because it was either on a different topic to their practical or they did not feel it reflected the diversity of marking schemes. Of these, one also admitted to struggling to understand the experiment described. Finally, of the students that used the report, half (15/31) had suggestions for improvement. These fell into three themes: having more samples and examples, having a topic more similar to their practicals, and various suggestions to include things that are currently in the guidelines or should be communicated by the teacher for the practical.

CONCLUSIONS

Overall, this project seems to be a success, due to the high take up of the resource and the favorable comments. From a student perspective, even if only one of them finds it helpful then it is worthwhile, but there are many comments indicating that a range of students have found it useful. However, the uptake also indicates a communication failure with some students. Running an introductory lecture to the resource would seem to be a reasonable effort to communicate and we cannot accept responsibility for where students have chosen not to engage. However, I hope that as the resource becomes more widely known, not only will students talk about it, and thereby advertise it to their peers, but also that teachers will be able to use it to illustrate their learning outcomes for practical reports. Although teacher opinion was positive, unless it is actively taken up as an example

and aligned with marking schemes, this has the potential to be a source of confusion for students. The implementation of all the student suggestions is impractical, although the provision of more examples of figures could be added to the online learning environment. However, it is hoped that this resource will act as a stepping stone for students to go on to read original papers in the topics they are studying.

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