

[P10] Is the traditional practical report redundant for large practical classes within the life sciences?

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Keywords: practical class; first year; assessment

Abstract

Teaching science should not only reflect the facts, but the 'how to' involved in practical experimentation and observation. Key to this process is the communication of experimental observations. However, the increasing numbers of students entering university has led to a decline in the number of practicals run and challenged the traditional method of laboratory class assessment - the practical written report. To date, I still maintain (as module leader) the tradition of written practical reports for our first year practical skills module; yet this has become an increasingly difficult task with larger student numbers and the need to provide both fair and rapid assessment and feedback. Indeed, it may be questionable whether writing a report meets all the required learning outcomes and provides practice in a range of key transferable skills. Recently, as part of an action research project I evaluated student questionnaire responses to help understand student expectations of first year practical class assessment and feedback and how this compared to their previous educational experiences. The results showed distinct differences between college and university where detailed practical reports formed the basis of practical assessment in colleges. Furthermore, students were often provided with extensive feedback before being allowed to resubmit their reports. Interestingly, over 80% (n = 104) of our students indicated that practical reports are a good way to assess their practical understanding, nevertheless just over 50% felt that writing practical reports alone demonstrate their full range of practical abilities. My evaluation of our student's opinions has led to a number of transformations in our teaching practice and changes in attitude amongst the staff teaching on the module, which is reported. Nevertheless, we still feel there is a place for the practical report, which can help to bridge the gap between college and university assessments.

Issues

This study set out to answer the following questions, which are pertinent to the way we run and intend to run our 1st year practical classes in future:

1. What are the best current practices to pursue in running a practical techniques module for 1st year students today?
2. What should the learning outcomes be?
3. Do current practices render the traditional practical report redundant for large practical classes within the life sciences?

Introduction

The basis of scientific knowledge and theory has arisen from practical observation and experiment (Shearer, 2007). Key to this process is the ability to show competency in practical skills, theoretical understanding and communication of the experimental observations.

To date, I still maintain (as module leader) the tradition of written practical reports for our first year practical techniques module; yet this has become an increasingly difficult task with larger student numbers and the need to provide both fair and rapid assessment and feedback. Indeed, it may be questionable whether writing a report meets all the required learning outcomes and provides practice in a range of key transferable skills. Furthermore, there are challenges in the sector in delivering practical classes. For example, the rapid expansion of knowledge has reduced curriculum time for laboratory training (Jones and Meyers, 2001); whilst widening participation and increased student numbers have imposed similar pressures on resources (Biggs, 2006). The time pressures on staff involved in practical report assessment has also increased (Hughes, 2004).

Background

The 'Essential Laboratory Techniques in Life Science' module at Kingston University is the first point of contact for most students to gain practical skills and competencies. Therefore it is vital that we get this initial student experience right as any competencies not gained here could resurface as major issues in later years causing problems in the laboratory management and assessment of our students. Therefore, the practical techniques module provides a breadth of skills in problem solving, team working, self management, writing and numeracy. Students also gain familiarity with laboratory equipment and methods used to handle data. Potential learning outcomes need to be clearly aligned with a range of assessment types (not just written reports). We also needed to take into account that there is a wide diversity of academic backgrounds and experiences which need to be catered for in our student population.

Practicals on the module run as a circus with the same practical repeated three times a day for one day of the week over a four week period. The running of our module has recently been affected by the fact that over the past two years student numbers have risen from 150 to 280. This effects the time in which feedback can be given and the load on each marker, although we understand a stabilisation of student numbers is to be expected in the forthcoming years as government targets for higher education entry are capped. It is also realised that many students will not write a full traditional report again after their first year. Many students are subsequently tested on their practical skills by proforma style questions and by multiple choice quizzes.

Methodology

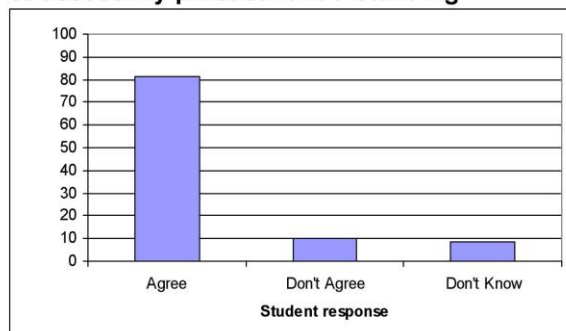
A student questionnaire (15 questions) was prepared and given to students to help understand student expectations of first year practical class assessment and feedback and how this compared to their previous educational experiences. Students were asked questions in three main areas, first a section to gain knowledge of their previous experience, second to understand how they perceived their current experience and third to look at their views on practical assessment strategies. This questionnaire was also followed up with discussions with fellow academics and laboratory technicians to determine their views. Visits to different sixth form colleges by members of staff to gain insight into the experiences of students before they arrive at university were also arranged. These members of staff then participated in a bio-curriculum alignment forum to 'educating ourselves about students' previous learning experiences' (Myers, 2007). Reflection practice was also followed on possible ways in which to enhance the module for the forthcoming year in relationship to expected skills and learning outcomes.

Results

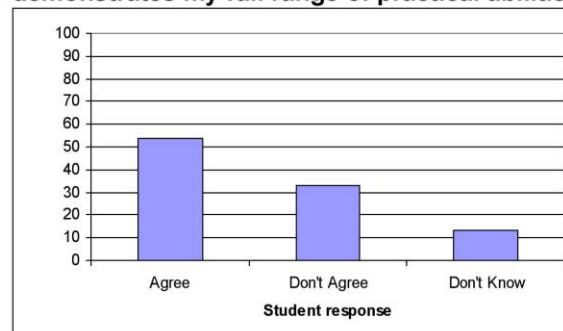
A total of 104 1st year students chose to take part in the study from a possible total of around 260 by answering the questionnaire. Nearly 80% of our students believed their previous educational experience had prepared them for practical classes at university with most students having experienced on average 14 hours of practicals a term in their previous education. Even though, most students today undertake less practicals than their counterparts several years ago around 65% of our students felt they did do enough practicals at university; less students (corresponding to) 55% said they would like more practicals. On being asked about how they felt their competency was in the laboratory nearly 70% of our students said they felt confident at using new laboratory equipment; nonetheless only 50% of students felt confident at performing the routine calculations associated with each practical. When we questioned students regarding how they were assessed for practicals over 80% of students felt written practical reports were a good way to assess their practical understanding (Figure 1). However, just over 50% of students thought writing practical reports alone demonstrated their full range of abilities. We asked students about other forms of potential assessment types. We found student attitudes to being assessed directly during practical classes were divided. However, over 70% of students felt multiple choice quizzes could be another good way to demonstrate their understanding of practical classes.

Figure 1. Results showing student responses to their views (%) on different types of assessment strategies for their practical classes.

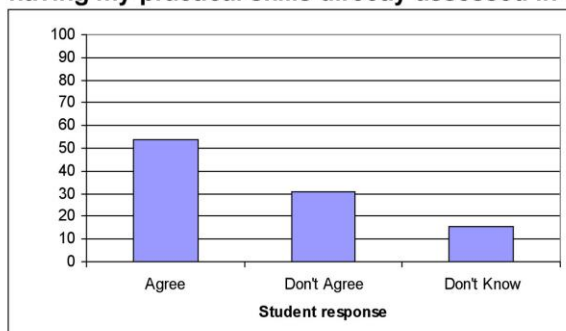
I agree practical write up reports are a good way to assess my practical understanding



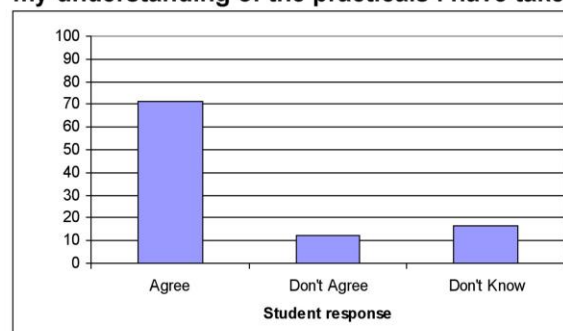
I feel that writing practical reports alone demonstrates my full range of practical abilities



I would like to demonstrate my practical ability by having my practical skills directly assessed in the lab.



A MCQ would be another good way to demonstrate my understanding of the practicals I have taken



My college visit revealed a college that had the facilities to run about 2-3 practicals a term, but lacked availability of equipment compounded by a low budget preventing any more practicals from being run. Practical experience gained by sixth form students (taking into account a variety of six form colleges visited by members of staff) seemed largely dependent on the individual college resources and to whether this was publicly or privately financed. We also found following discussions with class teachers that much of the biology A-level course has now become content heavy with most laboratory work often eliminated. We also found students were often provided with extensive feedback at college before being allowed to submit and in some cases re-submit their practical reports. This could be an approach which some students once they enter university education would find it hard to adapt from.

We found that increased marking loads for staff marking traditional written practical reports can lead to delayed turnaround of practical reports and feedback. Methods to help overcome such shortcomings are in place or are to be implemented. These include the rapid dissemination of generic feedback within strict time limits, and the potential advantages of pair working and peer assessment. Our discussions revealed that better alignment of learning outcomes is required to allow assessments that are linked not only to demonstrating written communication skills but to competency in practical skills and theoretical understanding.

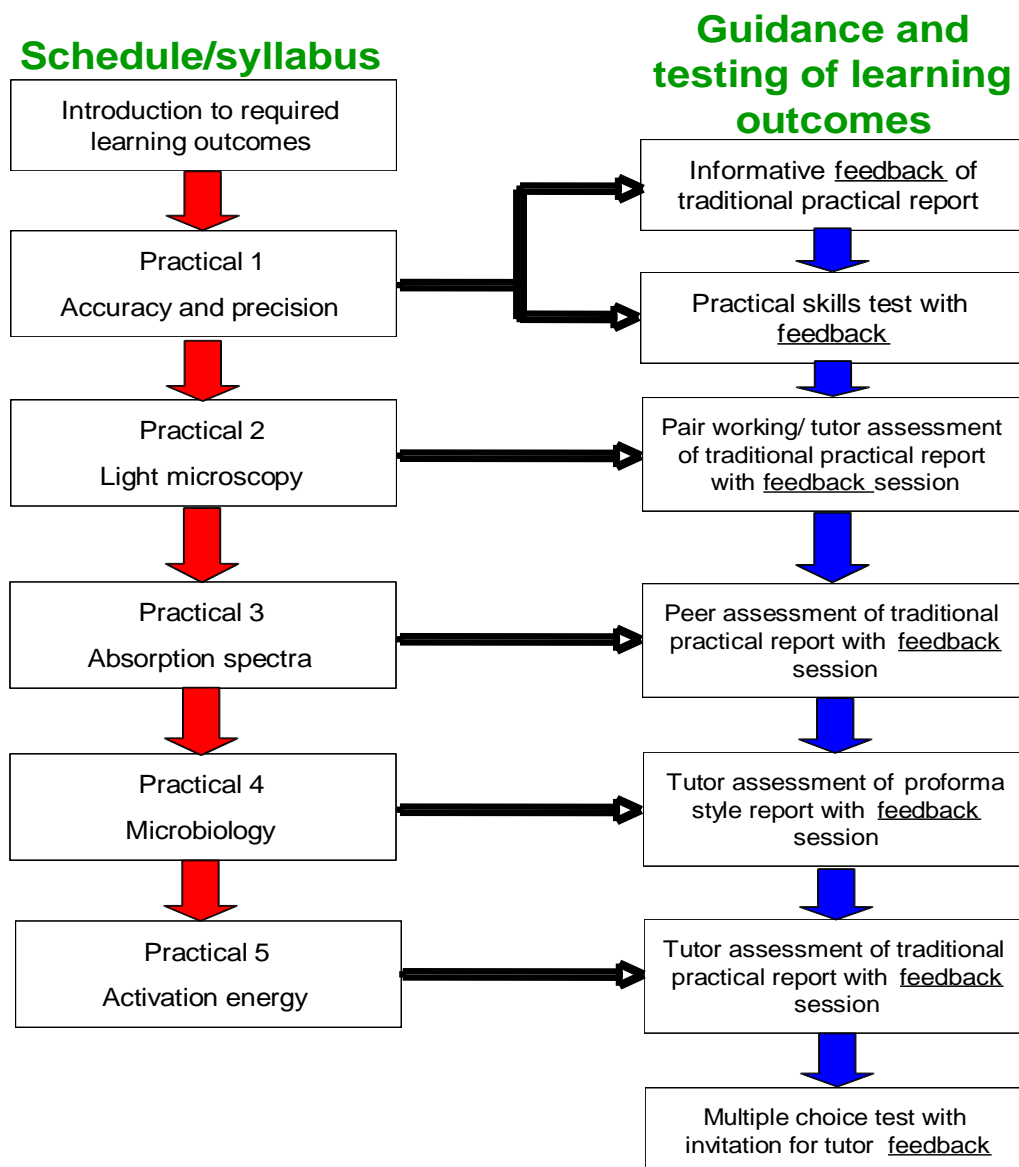
Conclusion

My evaluation of our student's and staff's opinions has led to a number of transformations in our teaching practice and changes in attitude amongst the staff teaching on the module. We understand that students do value the written practical report as a good way of assessing their practical understanding. However, it was clear that many students did not agree that writing practical reports alone demonstrated their full range of practical abilities. Currently, we have decided to maintain the traditional practical report. Nonetheless, reports should be brief (2-3 pages), be accompanied with clear guidance on how to structure the report and have an indication of where the marks are allocated. In addition, we feel the process can no longer be simply a case

of marking and returning practical scripts. Students have indicated that they would like not only rapid generic feedback but to have more direct explanation given to ways they can improve. Indeed this would make sense and alleviate the need for the return of practical reports several weeks later when students appear very often unable to relate to the tutor written feedback. In doing so, we have devised a schedule that aligns the syllabus with continuing guidance and testing of the learning outcomes (Figure 2). This allows a gradually build up of practical written skills and key skills through informative assessment, pair-based learning, tutor directed peer assessment to final independent report writing. Each of these strategies is complimented with not only an introductory tutorial session but a feedback tutorial for each practical class providing adequate guidance of the expected outcomes and ways in which the work could be improved. Since, many of our students will have had previous experiences where they were provided with extensive feedback we hope this helps students to more easily bridge the gap between college and university. Furthermore, to test competency in practical skills and theoretical understanding we have introduced alternative methods of assessment. We feel that their introduction allows a closer alignment with the learning outcomes to show competency in not only communication of experimental observations but practical skills and theoretical understanding. A short practical test is designed to include practice in basic techniques such as pipetting and illustrate the concepts of accuracy and precision and an end of module multiple choice test is designed to test across a range of concepts introduced in the module. The later can be used to test the learning outcomes from the recommended reading and tutorial sessions. We have also written a practical skills guide to help in basic biological calculations as this is one area of competency many of our students have openly admitted they are lacking in confidence. This includes self test questions.

In summary, it is hoped that the introduction of some of these practices such as pair based learning, peer assessment, direct practical testing and the multiple choice test will provide better alignment with the expected learning outcomes and help to relieve some of the load placed on markers. Even though, we feel the written practical report is not yet redundant it will be important to compliment it with a range of other assessment types in today's practical settings. We will continue to monitor this situation.

Figure 2. Layout of the techniques module showing the schedule/syllabus and the interlocking proposals for guidance and testing of the learning outcomes. The proposal provides for a close association of the learning outcomes with integrated feedback.



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