Laboratory practicals: facilitating student learning using online resources, VLEs and peer assessment

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This case study has been developed from data gathered through observations of the teaching component; interviews with the tutor; and focus groups and questionnaires with students from the current and previous cohort.

Background

This report concerns the improvements to the delivery and assessment of the practical component of a DNA module with the intent of getting students to better appreciate the process of scientific enquiry. Three major changes were introduced. Firstly, online, pre-practical support was developed. This support includes a website outlining the concepts (theory), the opportunity to create a hypothetical scenario (observation) and an experimental strategy (challenge) as well as a Flash animation of the actual practical itself. The animation is interactive (step-through) and includes calculations for the students to do in their own time. Secondly, the students now share their data via the University of Bath's VLE, and are encouraged to post comments, views and ideas in the chat room. Thirdly, the practical reports are peer assessed.

Reasons for introducing this teaching method

To get the most out of a practical students need to arrive prepared with a good understanding of what they are doing and why. The practical on DNA repair is taken by a diverse cohort of students; including those taking Natural Sciences who have not previously done any [biology] laboratory work. Therefore the lecturer produced a comprehensive series of support materials to reflect the differing practical experience of the students. Video clips, diagrams, animations and links to further reading allow students to 'dip in' at a level and format that suits them. The ability to analyse data is an essential part of the scientific process. Pooling data enables students to apply their theoretical knowledge for the first time and do some meaningful statistics with their own data set. There is also the additional advantage of seeing how their data relates to the rest of the group – a potential driver for future improvement. Finally peer assessment provides prompt and quality feedback on the work. It gives students an opportunity to develop their evaluation skills, ensures their familiarity with the marking criteria and reinforces what is required from a laboratory report.

Lecturer perspective

The lecturer wanted the practicals to be an activity where students not only learnt techniques but engaged with the process of scientific enquiry. She believes she provides a practical experience for students that is much more than recipe following: questions have to be answered and approaches devised. Equally she recognises to provide an appropriate challenge, sufficient support materials need to be in place so each student can attend the practical sufficiently prepared to meet the challenge. The online material provides such support but pragmatically she has introduced a quiz on the material which has to be completed before the students are allowed to take the practical.

She was also concerned by the level and variability of the feedback [on the lab reports] provided by the postgraduate markers. Inspired by Hughes' (2002) work on peer assessment she trialled the approach at Bath and was convinced by the data she collected that students can mark equally as well as experienced postgraduate demonstrators. In fact, the peer markers used a wider range e.g. 64.2 ± 11.8 as opposed to 63.8 ± 5.6 for the post graduates. Peer assessment is now used to provide the mark for the lab report.

The improvements in the quality of the data and written reports show students are learning more from these revised practicals, these improvements are particularly apparent in the Results and Discussion sections. There has been an improvement in practical marks (e.g. ~5% increase for the Natural Science students) and the quality of questions asked by students. The added benefit for the lecturer is the improved teaching efficiency; less time on marking and more on teaching support. An unexpected outcome from this strategy has been the increase in students choosing this area of research for their final year project.

Student perspective

The students appreciate the lecturer's approachability, passion for her subject and see a difference in the amount of time and effort she puts into her teaching compared to other lecturers. "*... was very approachable and her passion for the subject came across well*" is typical of the end of module questionnaire comments. The student interview also picked up on these themes and went further with students indicating because they could see the effort the lecturer had put in, they were more inclined to work hard themselves. They found the work challenging "*there's always something else to read*" and they knew she would not give them the 'answers' but point them in the right direction i.e. the guidance and support was not spoon feeding but a framework to allow students to find a solution. The level of background reading was a wake-up call to some, one student commenting that she now "*realised how much reading I ought to be doing*".

The student questionnaire brought out the expected skills: "*a better understanding of what is expected in a lab*" was one quote and 38% (24/64) of students listed [laboratory] report writing as a skill they had learnt, 20% mentioned laboratory skills. There were also wider benefits, 22 students listed skills along the lines of 'using additional sources' and 'how to read around a subject'; 8 students mentioned improved note taking and encouragingly 3 made reference to [increased] independent learning.

Issues

As with any change or novel approach there can be a degree of resistance, especially when the changes require deeper thinking. During the interviews there were the expected concerns raised by the students at marking other student's work for the first time but they had also taken onboard there were substantial benefits to doing this. This recognition is borne out by the subsequent questionnaire where 40% rated peer assessment as one of their top three most useful sources of information.

Benefits

One benefit the lecturer has noticed is the practicals finish earlier. Because the students arrive better prepared, they start sooner, are more efficient at working and hence complete the work quicker. This speed is not at the expense of the data, quite the contrary; the data produced by the students are now much cleaner and stronger than previously. In addition, observation of students' body language suggests the level of motivation is also higher.

The introduction of peer assessment and pooled data gives a social aspect to the learning – students now have greater reference to what their peers are doing and can learn from each other. The students do recognise this; e.g. for the peer assessment 80% agreed with the statement 'I learnt from others'. It is also evident in the posting streams on the VLE where students ask questions and discuss analysis online e.g. "*Have you got the TRR values for the result that you've attached? Shouldn't we use cpm% instead of cpm to plot the graph and draw the conclusions?*".

Reflection

The approach has helped students deepen their understanding of the process of scientific enquiry. The support has been targeted at the point of educational need, and this, combined with the lecturer's passion and approachability has been rewarded with more motivated, more able students.

References

Hughes, I. E. (2002) Case study 5: Peer-assessment of practical write-ups using an explicit marking schedule. In *Self- and Peer-Assessment: Guidance on practice in the Biosciences*, Orsmond, P. Centre for Bioscience, The Higher Education Academy: UK