

Teaching aids in pre-service teacher education

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Subject area: Pre-service biology teachers

This case study has been developed from discussion with the tutor and evaluation evidence collected from bioscience students and their mentors of the 2009-10 and 2010-11 cohorts.

Background

The context in which this specific contribution to bioscience student learning is set is that of one year, pre-service teacher education. The students involved are bioscience graduates training to become teachers of biology and science in secondary schools. The one year, Post Graduate Certificate in Education (PGCE) courses are 36 weeks long and part school (24 weeks), part university-based (12 weeks). The PGCE is awarded to those students who successfully meet both the Qualified Teacher Standards (QTS), set by the government (Training and Development Agency, 2008), and the university assessment requirements. Award of the PGCE and successful completion of currently, literacy, numeracy and ICT skills tests, results in provisional qualified teacher status.

The case study of bioscience student learning experience reported here involves pre-service biology teachers in addressing their personal understanding of biological concepts and then employing this knowledge to develop and use a teaching aid, that supports the learning of these same concepts, with the pupils they are teaching in secondary schools (11-18 years). There are four strands to the students' learning experience: *designing and developing* the teaching aid; *using* it in teaching a class; *evaluating* the impact on pupils' learning and, then; *presenting* the aid to their fellow bioscience students and the team of mentors; experienced biology teachers trained in supporting the pre-service teachers in school-based elements of the course.

In the course of their teaching experience, bioscience graduates will encounter situations where they and their pupils have difficulty understanding an aspect of biology and where there are no suitable teaching resources in the school. Such occasions offer an opportunity to be thoughtful, innovative and resourceful in *designing and developing* a teaching aid before *using* it in their teaching to support pupils' learning. Additional contributions to bioscience students' learning are made through tailoring the work with the teaching aid to university-based assessment by engaging them in carrying out a piece of classroom-based, small-scale research aimed at *evaluating* the effectiveness of the aid. The method to be used in the research is specified as a pre-test/post-test approach, designed to gauge the impact of the aid on pupils' knowledge, understanding and views on the usefulness of the activity. The bioscience students are required to engage with social science research literature to support both the design of their methodology and the research instruments.

Mentors, or the usual teacher of the class selected for the study, are also involved in the learning experience through discussing the development of the aid with the pre-service teacher and writing an evaluation of the lesson(s) in which the aid is used. At a twilight session, the bioscience students are involved in *presenting* the aid to their pre-service teacher colleagues and the mentor team, giving an opportunity for the bioscience graduates to disseminate their ideas to an audience of peers and for the mentors to be engaged in the evaluation of the teaching aids and presentations of all the students.

Reasons for introducing the teaching/ learning experience

In the last 10 years, successive governments, through the departments responsible for education and the General Teaching Council for England (GTCE, 2011), have promoted the notion of 'practitioner-led research' and encouraged teachers to get involved in research as part of school improvement and professional development. The development, use and evaluation of a teaching aid is a learning activity that supports bioscience students in their first steps along such a pathway and, through locating the university assessment at M level, supports governmental aspirations of teaching as a Master's level profession with research-informed practice as a central tenet. This learning experience supports bioscience students in seeing research-informed practice as key part of their work rather than as an 'add on'.

A further important contribution of the learning experience is that it gives ownership of what they are teaching to the bioscience students. In times when so much of the school curriculum is prescribed by statute (QCA, 2007), this learning activity places students in a position where they are initiators of new knowledge and understanding rather than transmitters of prescribed content.

The PGCE is an intensive course which places students under considerable pressure. This pressure is most keenly felt in school-based periods of the course where the immediate demands of planning and teaching lessons need to be balanced with involvement in the pastoral and administrative roles of the teacher and the requirements of university-based assessment and coursework. Another reason for introducing this learning experience is that it provides close integration of school-based work with university-based teaching and assessment while at the same time contributing to the development of QTS. Such an approach to learning offers efficient use of both school and university-based time whilst also contributing to the bioscience students' holistic view of the course.

Lecturer perspective

The lecturer's perspective is that of developing the quality of biology education in a broader sense; for the bioscience students as new entrants to the teaching profession and for the team of 17 or so mentors and their science department colleagues in the schools in partnership with the university. Engagement of all parties involved with the bioscience students in this learning activity places the teaching and learning of biology at the centre of their professional development. This is particularly important as generic issues such as assessment and class management have been the all consuming concerns of pre-service

and qualified teachers alike. Involvement with the teaching experience described here provides learning for the bioscience students and continuing professional development (CPD) for the teachers. For both it requires considering their own understanding of biological concepts, the pedagogies they use in enhancing pupil learning and, for the teachers, engaging with university-led elements of assessment at M level. Overall, this learning experience raises the standing of the teaching profession through a commitment to developing and sharing effective practice in order to improve learning outcomes.

Students' perspective

End of course evaluations for the 2009-10 and 2010-2011 cohorts of bioscience students show that all rated the experience of the teaching aid activity as very good or good. Qualitative comments indicated that the broadening of more traditional assessment to encompass creative skills, such as the design, development and construction of the teaching aid and classroom-based research skills were welcomed. For one individual, who was *'not enthused by conventional assessment'*, it provided an *'unexpected opportunity to shine'*. The requirement to present their aid to peers and mentors was anticipated with trepidation by many but most enjoyed the evening, the questioning by mentors and peers and warmed to the mentors' assessments and comments which tended to be more generous than those of their university tutor!

Mentor evaluations for the same period rated the learning experience as very good or good with qualitative comments confirming that valued teaching skills were developed, that it was *'good preparation for presenting at departmental meetings'* and *'I'll be using that aid with my year 9 class next week'*.

Issues

Most bioscience graduates are well versed with research conventions in the pure sciences, particularly those who have completed a laboratory-based study as part of their undergraduate dissertation. They are unfamiliar with research protocols of the social sciences and adjustment to these in the early stages of this learning activity is a challenge for some; limitations on control of variables with human subjects and the balance of qualitative with quantitative data prove especially challenging

Some students express concerns about their creativity and skills in designing, developing and constructing teaching aids. This has been addressed through sharing examples from previous cohorts of pre-service teachers which illustrate generic approaches such as matching the aid to different types of learners, making the abstract concrete, making small large, making microscopic macroscopic, making 2D 3D. Showing that simple ideas can be effective also helps, such as asking 11 year olds to draw around their body shape on old wallpaper rolls and then getting them to cut out and place, or draw within the outline, body organs such as the heart, liver stomach, kidney, bladder, uterus, etc.. Although simple, this teaching aid quickly identifies pupils' misconceptions about the size, shape and location of organs within the body

Benefits

There are benefits for all of the partners engaged in this learning activity; bioscience graduates/pre-service teachers, mentors/experienced teachers, pupils and university tutor. This approach to bioscience student learning not only integrates school and university-based activities but also ties phases of the course more closely together, unifying learning from different course elements and engaging all parties involved. Pupils warmly receive the enthusiastically presented, innovative approaches to the teaching and learning of biology. Such a holistic approach contrasts with previous, less inclusive partnership activities which contributed to the perception of a 'them' (university) and 'us' (school) arrangement.

Reflections

Teaching for learning involves all practitioners, beginning or experienced, in schools and universities, in trying out different approaches and resources, observing their impact and then reflecting, usually informally, on what is working well and what needs 'tweaking'. For bioscience graduates engaged in pre-service teacher training, evaluation is a routine post-teaching activity that leads to changes and developments in their pedagogy. The learning activity described here places the emphasis of their learning firmly on the conceptual understanding of biology and encourages bioscience students to approach routine aspects of their everyday activity in a more systematic way. In addition, it increases their professionalism by requiring them to make their work public and go beyond their particular school situation to sharing the results of their labours with their peers and teachers from other schools. For some this sharing extends to the wider national and international communities of science educators through publication in professional, peer-reviewed journals.

References

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