

Increasing the subject knowledge of trainee teachers

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Improving the subject knowledge of trainee science teachers – current provision and new initiatives



When selecting candidates for Initial Teacher Training (ITT) it would be unusual to find the perfect trainee who exactly meets all the criteria relating to subject knowledge. In our own institution, for example, a large proportion of prospective trainees have areas in their subject knowledge that need to be addressed in order for them to reach Qualified Teacher Status (QTS). Currently, as a result of the interview and during the training process, these individuals are set targets and strategies are negotiated to establish how they might meet their individual knowledge requirements. Some taught sessions, led by both tutors and trainees, are organised to meet the more common needs although, due to the limited time available, it would be true to say that a significant proportion of the topics need to be addressed through supported self-study.

But what of the trainees who would benefit from help *above* the norm? And what of those prospective trainees who might seek to train as physical science teachers, have suitable personal skills, but whose academic qualifications do not match closely enough the selection criteria? The TTA is aware of these possible situations and is currently financing two schemes in an attempt to address them. Outlined

below are two approaches to the enhancement of subject knowledge for those following any route (see Table 1) to the award of QTS in secondary science.

Table 1 Current routes into secondary science teaching (adapted from TTA, 2003a).

<i>Title of route</i>	<i>Outline of route</i>
Post Graduate Certificate of Education (PGCE)	For graduates or equivalent, the PGCE normally takes 9 months, full-time.
BSc + QTS	a A three-year undergraduate route of which the final year is equivalent to the PGCE year. b A two-year undergraduate route with suitably qualified entrants exempt from year 1.
School Centred Initial Teacher Training (SCITT)	SCITT is based in and run by schools. Most SCITT programmes are run in collaboration with a university or college and enable trainees to gain a PGCE as well as QTS.
Registered Teacher Programme (RTP)	For those who are 24 years or older and have successfully completed two years of higher education. A school employs the trainee as an unqualified teacher and the trainee must complete their degree while they work and train.
Graduate Teacher Programme (GTP)	Similar to RTP but designed for those who already hold a first degree. Typically takes over 12 months.

ABSTRACT

A number of potential entrants to teacher training in secondary science are deterred due to lack of breadth and depth in subject knowledge. This article outlines two Teacher Training Agency (TTA) sponsored approaches to enhancing the subject knowledge of trainee teachers during and prior to their formal training period.

Topic 1: Subject knowledge booster courses

Subject knowledge booster courses have replaced the subject support and supplementary support courses previously funded by the TTA. These, if the reports of our own trainees are representative, have been received very favourably. For example, Emma-Jayne, a young biology graduate, writes:

Since I have been coming to the course I have noticed an increase in my confidence in teaching chemistry and physics at key stage 3. One particularly good aspect of the course has been that it has run alongside my teaching practice so any queries I've had I have been able to discuss during the Saturday lectures. Being able to practise and discuss experiments has also been very helpful in improving my understanding of possible misconceptions and problems pupils may face.

Participation has not been restricted to biologists and Jenny, a mature chemistry graduate, commented that:

I initially made the decision to attend these classes as I felt there were significant gaps in my science knowledge. The Saturday classes provided an opportunity to learn, expand and fill these gaps in a small informal setting and were a real benefit when teaching the same subject matter in school myself as there were many tips and hints that the tutors and colleagues were able to pass on and share with each other. It was good to actually be able to get 'hands on' experience with various practicals before attempting them in the

classroom. The experience enabled me to learn and share ideas alongside others and proved an advantage to my teaching.

A total of 17 three-year contracts (TTA, 2003b) to run subject knowledge booster courses have been awarded by the TTA and each will occupy two weeks full-time study or the equivalent on a part-time basis. Typically, courses for those already accepted on a route to QTS are held over a series of Saturdays, so as to avoid regular Monday to Friday commitments. For our own region, examples of course schedules are detailed in Table 2. However, a series of Saturday sessions might not suit everyone and, as an alternative, our own institution will be offering 2004 and 2005 courses in the first two weeks of September in an attempt to plug the knowledge gap before mainstream PGCE trainees embark upon their full-time course, while at the same time avoiding pre-course primary experiences and/or induction weeks.

Since our own past experience, and that of similar institutions, is that the majority of trainee science teachers have strengths in biology-related sciences (Twidle *et al.*, 2002) and perhaps are less confident in some aspects of physical science, our course aims to cover the physical sciences only (Table 3). However, broader approaches are available and the list of advertised courses (TTA, 2003b) contains a mix of the three sciences, from individual sciences to a combination of all three.

Although members of these courses are largely self-selecting, applications might be as a result of advice to the individual by an interviewing or supervising tutor. Irrespective of the trainee's host organisation, these courses are free to participants.

Table 2 Typical schedules for booster courses.

<i>Institution</i>	<i>Date of first advertised 2003–2004 session</i>	<i>Date of final advertised 2003–2004 session</i>	<i>Number and duration of sessions</i>	<i>Title of course</i>
University of Leicester	November 8	February 7	6 sessions of 6.5 hours	Secondary science
Loughborough University	November 1	March 20	10 sessions of 4 hours	Physical sciences (see Table 3)
University of Wolverhampton	September 17	February 20	10 sessions (duration not advertised)	Secondary science

Table 3 Outline content of the Loughborough booster course.

Physics topics	Chemistry topics
Force and motion	Investigative science
Electricity and magnetism	Atomic structure
Energy	Patterns of behaviour
Waves	Organic chemistry
Earth and space	Rates of reaction

Approach 2: Pre-Initial teacher training: Physics Enhancement Programmes (PEPs)

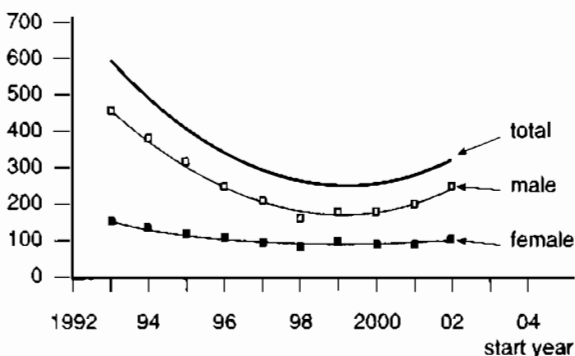
Not surprisingly, as highlighted in the Council for Science and Technology report (2000), there is a strong correlation between a teacher's highest subject qualifications and their levels of confidence in teaching that subject. However, the same document also reports that 37% and 29% respectively of those teaching key stages 3 and 4 physics do not have an A-level in the subject, while 76% and 66% of those teaching the subject do not have a related physics degree. Although there has been a small increase in the recruitment of male physics graduates to teacher training courses recently, the corresponding figures for females are less encouraging (see Figure 1) and the overall recruitment of physicists is still only approximately half that of ten years ago.

To compound the problem, young science teachers in post have reported difficulty in identifying and accessing suitable subject-related professional development materials and courses. For example, Victoria, a biology graduate, with no formal chemistry qualifications post-16, is in her third year of teaching and has recently taken on the teaching of chemistry to years 10 and 11 as part of a single science course. Victoria reports that:

I accept that there is a need to improve my own subject knowledge but am not aware of any appropriate courses to meet my needs. I am currently relying upon the support of more experienced colleagues, referring to pupil text books and Internet resources such as chem4kids.com and Bitesize.

What can be done to improve the situation? The TTA response is to focus upon a potential pool of applicants

Number of PGCE acceptances for physics

**Figure 1** Acceptances to PGCE physics courses (adapted from GTTR, 2003).

who may have a desire to teach physics but lack the relevant background knowledge to be suitable and confident specialists. Following on from a similar scheme for mathematics, which began in February 2003, two national pre-initial teacher training pilot courses, or Physics Enhancement Programmes (PEPs), are being offered, starting in February 2004. It is intended that each of these pilots will recruit 20 trainees, with the exercise being repeated in 2005. Each programme is full time for 26 weeks, prior to the trainees starting on a recognised route to QTS. If these courses are successful it is hoped that they will subsequently be rolled out nationally. The aim is to increase the trainees' physics subject knowledge so that they can teach with confidence to key stage 4, whilst those with the aptitude could teach post-16.

Following on from the mathematics and physics pilots, there are plans for a similar scheme to be trialled for chemistry, beginning in February 2005. The content of these proposed physics enhancement programmes is to be based around seven themes:

- Mechanics
- Molecular theory
- Fields and waves
- Electricity and magnetism
- Astronomy and cosmology
- Quantum and relativistic phenomena
- Atomic, nuclear and fundamental particle physics

The TTA recognises that spending 26 weeks in order to attend a full-time pre-training course is likely to have financial implications for those who have to give up employment in order to attend. As a result, these

courses are being offered at no cost to the trainees and a bursary scheme, similar to that for PGCE trainees, is in operation, with participants receiving a payment of £150 per week for up to 26 weeks. In addition, the Gatsby Foundation is intending to offer support to successful PEP trainees, not only during their PGCE year but also during their induction period.

Final comment

In this article, we have described present provision and ongoing initiatives to meet recruitment targets for physical science teachers. On this occasion the TTA is to be commended for recognising that there is

a problem to be addressed, devising an approach that may help, and carrying out suitable pilots before introducing the schemes on a larger scale.

Nevertheless, although these schemes may improve the subject knowledge and supply of new entrants to the profession, retaining them is a different issue. Workforce remodelling alone cannot solve all the problems. No science teacher can be effective and happy in their day-to-day work without the competence and confidence needed to teach the subject matter. But in addition, an *enthusiasm* for the content being taught is required and unless this issue can also be addressed, retention will continue to be problematic.

References

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