

Science Teacher Education

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This section focuses on the education of science teachers, and aims to communicate ideas and strategies which will assist science teacher educators to enhance and enrich their programs.

The Impact of Standards-based Assessment of Trainee Secondary Science Teachers in England

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Introduction

Initial Teacher Training (ITT) can be seen as a vehicle for introducing changes into the school system. For this to have maximum impact, initial teacher training needs to do more than produce new teachers who are familiar with and ready to implement new ideas in their own teaching. The changes introduced via ITT also need to reach and influence experienced teachers; but how can this be done?

The majority of secondary science teachers in UK enter the profession by completing initial teacher training (ITT) in the form of a one-year postgraduate course (Post-graduate Certificate in Education, PGCE). The course is available to graduates in a science discipline, e.g. Biology, Physics, Chemistry, or related subject such as Medical Science or Engineering. PGCE courses are mostly run by Higher Education Institutions (HEIs), such as universities, and are required to last thirty six weeks, with at least twenty four weeks of school-based practical experience. Most courses prepare trainees to teach science to the 11-18 years age range. The course offered by the University of Warwick is a fairly typical model, with trainees spending most of the course (68%) in schools. There are two periods of full-time school-based placement, the first lasting six weeks and the second fifteen weeks. Prior to each, the trainees visit their placement schools two days per week for several weeks to orientate and familiarise themselves with the school, its science department, schemes of work, resources

and the pupils they will be teaching. The course is expected to prepare trainees to teach the entire science national curriculum to 11-14 year olds, at least their specialism (Biology, Chemistry or Physics) to 14-16 year olds, and normally Biology, Chemistry, or Physics to 16-18 year olds. Trainees are expected to become competent at teaching the full ability range that is normally found in mainstream schools.

Prior to 1992, the relationship between training institutions and schools was informal, with schools providing periods of placement for trainees and the training institutions fulfilling most other roles. The training institutions had formal responsibility for the design and delivery of all training. They were also solely responsible for assessing trainees' progress, although in practice teachers in the placement schools were consulted. Trainee progress was largely a matter for the professional judgement of tutors, since there was no specific national framework. However, in 1992 there was a radical change, when the government published a new set of requirements (DfE, 1992) obliging HEIs to work in formal partnership with schools. The time that trainee teachers had to spend in schools was increased and school staff had to become fully involved in a partnership with the HEI, planning and delivering' training, and taking part in the selection and assessment of trainees. To finance this shift in responsibility, some funds were transferred from HEIs to schools. The training institution and the schools had to build up a profile of each trainee's progress against a set of descriptors setting out profession-

al competence. These changes have had a major impact on how trainee teachers learn to teach.

Two developments, resulting from the 1992 ITT changes, are likely to have impacted on the teaching of experienced teachers: i) the introduction of a competence-based system of trainee teacher assessment and ii) greater involvement of schools in the initial teacher education process. This paper explains how competence-based assessment is used. It also considers the way in which this form of assessment, together with a shift toward school-based training, could be promoting change in schools. The benefits and disadvantages of this system are discussed.

Assessment against standards

The 1992 (DfE, 1992) requirements included a series of statements describing the areas that a newly qualified teacher should be competent in. Later, these were replaced by the Standards for the Award of Qualified Teacher Status (hereafter referred to as the Standards) introduced in 1997-8 (Department for Education and Employment, 1997) and revised in 2002 (Department for Education and Skills/Teacher Training Agency, 2002). The recently revised standards are divided into three sections:

- Professional Values and Practice

These standards describe eight attributes that trainees should display when working and communicating with pupils, colleagues, and other adults; evaluating their own teaching and showing an awareness of their own responsibilities.

- Knowledge and Understanding

These standards describe the subject-knowledge that trainees should demonstrate including: knowledge of the curriculum; the various influences on pupils' learning; where to get advice on pupils with special needs; how to use Information and Communication Technology in their teaching, and how to promote good behaviour and learning.

- Teaching

This section is further divided:

1. Planning, expectations and targets

These standards relate to the trainees' ability

to plan effective lessons that challenge pupils and take account of their prior learning, age, ability and diversity.

2. Monitoring and assessment

This section addresses the trainees' ability to use a range of assessment techniques, give feedback and relate pupils' progress to national criteria. They must also show that they can record assessment data methodically and use the data with assistance, to identify pupils who are underachieving, and to produce reports for third parties. A completely new standard relates to the ability to recognise the levels of attainment of pupils for whom English is an additional language.

3. Teaching and class management.

The standards in this section relate to the criteria that have more traditionally been used to assess trainee teachers' progress, such as the ability to build successful relationships in the classroom and deliver lessons that motivate pupils. Others refer to use of ICT, support given to pupils with different needs, and time management.

The standards represent a significantly more demanding set of requirements than any applied prior to 1997-8. In order to gain Qualified Teacher Status (QTS), trainee science teachers have to meet over forty standards (in the 1997-8 version there were over eighty!), as well as additional requirements in numeracy, literacy, and Information and Communication Technology (ICT) competence. The standards are clearly specified, but there is little guidance on how to interpret them. It is implicit that competence must be demonstrated consistently and that it is not enough for the trainee to show achievement on only one occasion. Most of the standards can only be reached when the trainee demonstrates competence during the school-based placements. This means that a thorough base of evidence against the standards has to be compiled during the school placement in order to justify judgements of standards being met or not met.

During school-based placements trainee science teachers are formally supported and assessed by two teacher-mentors. Mentors are expected to be experienced and successful teachers, who receive

initial and on-going mentor training from the HEI their school is working in partnership with. In University of Warwick partnership schools, one of the mentors is a science subject specialist, who is expected to co-ordinate the school-based assessment of the trainee. In this task the Science Mentor is supported by a "Professional Mentor" (usually a senior teacher, in other institutions sometimes known as the "Senior" or "General Mentor" (Shaw, 1995, Tomlinson, 1995) and by two visiting HEI tutors, one of whom is a science specialist, who will liaise with the school and carry out moderation observation of the trainee teaching. The Science Mentor is in the best position to collect assessment evidence, which is initially used formatively, and later to make summative decisions, which determine whether the trainee teacher has met the standards. In the University of Warwick partnership assessment is carried out using a four-point scale (Fig. 1). This is adapted from the OFSTED scale (Office for Standards in Education, 1997) used when inspecting the performance of trainees on initial teacher training courses. Trainees must achieve at least Level 3 in all standards by the end of the course.

Scale for the assessment of trainee teachers used by the Office for Standards in Education	
Level 1	Area of strength
Level 2	Area of competence
Level 3	Acceptable, but needing improvement
PASS	
FAIL	
Level 4	Area needing further sustained effort to achieve competence

Figure 1

In the past, the competence of trainee teachers was primarily judged by their skills in classroom management. The standards have forced all involved to pay attention to other aspects of professional competence. During school-based placements, mentors have to consider how the trainee teacher is progressing across a wide range of standards, which address issues that may well

have been neglected in the past. For example, the 1997-8 standards drew attention to the importance of developing children's wider life skills through subject studies, e.g.:

Those to be awarded Qualified Teacher Status must, when assessed, demonstrate that they:

...understand the contribution that their specialist subject makes to the development of key skills.

...plan opportunities to contribute to pupils' personal, spiritual, moral, social and cultural development.

Use teaching methods which sustain the momentum of pupils' work and keep all pupils engaged through:

...exploiting opportunities to improve pupils' basic skills in literacy, numeracy, IT and the individual and collaborative study skills needed for effective learning, including information retrieval from libraries, texts or other sources.

...providing opportunities to develop pupils' wider understanding by relating their learning to real and work related examples.

Standards-based Assessment and Trainee Progression

The basic standard of competence required of the new teacher is set so high that it is difficult to differentiate between progressive levels of performance. In order to help trainees learn and make progress, it is important that a system is used that allows them to monitor their progress as part of the formative experience. To this end, in several training institutions, HEI tutors and school mentors have worked to produce a series of level descriptors for each of the standards.

The University of Warwick's level descriptors for the 2002 standards relating to a trainee's ability to use ICT effectively in their teaching are:

Level 1 Exploits ICT imaginatively and independently to support and extend teaching and learning.

Level 2 Selects and uses ICT confidently and can tailor it appropriately in teaching and in organising pupils' learning.

Level 3 Can select and use ICT resources appropriately in their teaching and provide opportunities for pupils to use ICT in

relation to the subject. ICT is used within professional and legal guidelines.

Level 4 Failure to demonstrate Level 3.

The level descriptors are formative, so that a trainee teacher can see how he or she is performing, and also what needs to be done to improve further.

Potential benefits of standards-based assessment

When first introduced, some experienced teachers expressed considerable doubt as to whether they met the standards themselves. For example, there are references to the use of ICT in planning and teaching that, mainly because of resource issues, many practising teachers cannot meet. Indeed some trainee teachers find it difficult to make full use of ICT in schools, because the necessary hardware, software, expertise, and enthusiasm are not yet present in the science department they find themselves in. There is evidence that the standards expected of newly qualified teachers are, in some aspects, in excess of those demonstrated by some experienced teachers. So, the standards can be seen as an attempt to raise standards and expectations in schools as a whole via new recruits to the profession and, as such, as part of a political drive to raise standards generally within education in the UK (Martin & Cloke, 2000).

The standards have made clearer than ever before what is expected of newly qualified teachers. This makes it easier for trainee teachers, and also those responsible for their training, to feel secure about the aims of an ITT course. Trainees have a meeting with their science mentor once a week, and the standards can be used to generate regular, competence-based feedback to trainees based upon transparent criteria. They can also be adapted through the use of level descriptors, to provide trainees with a structured succession of targets during the course, so that they can be motivated by a sense of progress. The reaction of experienced teachers to the introduction of the standards reflects the fact that they do represent an attempt to spell out clearly what good teaching is about. Many mentors have reported that their mentoring role and the use of the standards has caused them to reflect on their own teaching. In

this respect, the standards have promoted good teaching in all areas, some of which may previously have been neglected or paid insufficient attention.

Problems with Standards-based Assessment

There were only seven months between the publication of a consultation document on the 1997-8 standards and the point at which PGCE courses had to start using them. There was no guidance on how to interpret them and, as Martin and Cloke (2000) point out, the speed of this introduction meant that there was no time for HEIs to develop a framework in which to use and understand the standards effectively.

The interpretation that mentors place upon a particular standard will be influenced by their own teaching experiences, the nature of the school in which they teach, and the nature of the pupils with whom they work. The mentor's own level of competence as a teacher will also, inevitably, influence their interpretation and judgement. By contrast, the HEI tutor has a much broader perspective, working with a range of schools in many different localities and influenced by different socio-economic factors, and seeing the work of many more trainee teachers than the mentor does. Under the old system, HEI tutors were able to use this perspective to reach judgements about trainees, and it is also vital to the moderation role they now have in assessment. As Field and Philpott (1998) point out, school mentors and university tutors are engaged in a process of trying to find a balance between the standards and their own professional judgements.

Another problem with standards-based assessment is the necessity to compile evidence to support the judgements. This places a great pressure upon the trainee to maintain a comprehensive and well-organised paper trail of all their planning, preparation and other activities. This requirement is quite challenging for some trainees, many of whom may show considerable promise as dynamic and even inspirational teachers, yet have difficulty organising paperwork. There is a real risk that some potential new teachers may be deterred from their chosen path early on in their career by the apparently bureaucratic nature of the training process. It also places a considerable burden upon

mentors, who have to maintain records in the relatively modest amount of time they are allocated for working with trainee teachers (Geen, Bassett & Douglas, 1999).

The standards and the framework in which they are presented suggest an agenda for ITT in which certain aspects of learning to teach are given priority over others. For instance, there are relatively few references to interdisciplinary education, perhaps reflecting the emphasis that has been placed on relatively narrow subject-based approaches to the curriculum in recent times. It is also argued that the reductionist approach that was used in the creation of the standards has led to a diminution of an holistic view of teaching:

"The Standards do not capture the profession of teaching"

"(they) appear to encourage a view of teaching which presupposes that it can be broken down into discrete areas, denying that teaching is far more complex than such a set of skills."

Martin & Cloke (2000)

Finally, the standards only refer to the measurable. The true worth of a new teacher may not be captured by a set of figures pertaining to the standards. Some individual trainees will be undervalued by a standards-only profile, while others may appear more proficient than they really are.

Conclusions

Despite the difficulties inherent in standards-based assessment, those involved in ITT find that there are ways of managing the process to good effect. The standards may appear to have simplified, ignored, or overlooked important aspects of teaching. However, it is clear that they have also drawn attention to some neglected aspects of developing teacher competence. This means it is impossible for those delivering ITT, including schools, to ignore any of the attributes of good teaching set out in the standards. School-based mentors are obliged to consider this range of attributes when assessing trainee teachers, and this encourages them to evaluate their own practice and performance. There are clear benefits to a standards-based assessment of trainee teachers

in a partnership between schools and HEIs. One of the benefits is the influence that the model is likely to have on experienced teachers.

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Website

The Standards for Qualified Teacher Status can be viewed on the following website:
<http://www.canteach.gov.uk/info/itt/requirements/index.htm>