Overview of Initial Teacher Education (ITE) provided by Higher Education Institutes (HEIs)

Context

The position for ITE across the UK is in a state of flux. ITE provided by HEIs is outlined in this document.

Historically strong partnerships exist between schools and universities to provide high quality professional training and education. The best tutors and mentors of science education are themselves good teaching practitioners, who are able to model effective science teaching. As well as having considerable experience of teaching children and young people in schools they are good teachers of adult learners.

It is important that there is development of sufficient quantity and quality of science teachers to meet schools' needs, and hence to ensure high quality science education for all children and young people. There is a robust body of evidence to suggest that HEIs have a pivotal role to play in teacher education and we recommend that all ITE routes recognise this and continue to work closely with them (DfE, 2011; Ofsted, 2010; Ofsted, 2011). Schools have much to contribute to the ITE process and we recommend that HEIs and training centres should involve schools in key elements of their courses including recruitment, training, assessment and quality assurance.

Where well-qualified candidates have a non-specialist science background, e.g. in biomedical science, forensic science, psychology or sports science, they should take a high quality Subject Knowledge Enhancement course before they start their secondary ITE course.

All those teaching science to children and young people in the UK have the opportunity through the HEI route to gain a relevant qualification, such as a PGCE/PGDE. High quality initial teacher education courses enable preservice teachers to re-construct and re-conceptualise their ideas and beliefs about science teaching and learning. Without this opportunity, there is a tendency for teachers to default to teaching in the manner in which they were taught themselves, which may limit the capacity to improve (Loughran, 2007). They may also otherwise be inclined to imitate teachers that they observe and work with in schools. Whilst this may lead preservice teachers to become functionally competent, they should also have the opportunity to theorize about and critique practice (Walkington, 2005). HEI ITE courses meet or exceed the current national standards that apply in their part of the UK. (For example, in England ITE criteria are produced by the NCTL (DfE, 2016

Our experience of working with colleagues from many countries around the world suggests that the UK is still seen as one of the leading educational contexts, with world class educational academics and world-leading expertise in the field of science education. If we are to further enhance children's science education then it is important that we build upon this strong foundation. The best tutors and mentors of science

education in HEIs have a secure understanding of educational research, having completed higher level qualifications in education themselves, and are research active.

The best tutors and mentors of science education in HEIs contribute to the development of the subject, for example through writing textbooks, working on curriculum committees, and contributing to subject associations. They also promote cooperation between teachers, support agencies, professional bodies, scientists from local communities, and university science departments.

There are many constraints within which ITE courses operate, which may include: The relatively short period of time for taught sessions, with up to 60 days available on university partnership PGCE courses in England; variability in capacity of school partners to support preservice teachers owing to staff turnover, teacher shortages, and teachers' workloads; financial constraints in both schools and HEI providers, activity to demonstrate compliance with requirements of external bodies, such as the NCTL and Ofsted in England. All support for new teachers should recognise that ITE is introductory, and should be considered to be only part of the teacher's professional learning

Effective support in the NQT year is critical if we are to retain new science teachers in the profession, and if they are to continue to develop into effective science teachers once in post. They should have the opportunity to undertake relevant high quality subject-specific professional development activity, for example led by experienced science consultants and advisers. HEIs highly recommend that teachers have the opportunity and support to complete their master's level studies during the early part of their teaching career, building upon what has been learned in the initial phase.

Best practice in an HEI route seeks the opportunity for preservice teachers to

Critically engage with ideas about the nature of science, and its implications for teaching and learning, including consideration of enquiry-based learning in science education and the purposes of practical work. They should be supported to become confident and competent in running practical activities, including health and safety induction and risk assessment, as well as aspects of behaviour for learning specific to practical subjects, for example managing resources and pupil movement. They should have opportunities to learn about assessment of science enquiry and other practical work, in line with research evidence and with current examination requirements in the relevant part of the UK.

Develop 'a commitment to teaching science for understanding', including critical consideration of how children learn in science, children's alternative conceptions and how they might be overcome (Loughran, 2007:1044)

Develop an understanding that teaching and learning in science is 'likely to be multiple (pluralistic) and content-, context- and time-dependent (relativistic)' (Baird *et al*., 1991:181), i.e. that there is not one right answer as to how to teach. This should include opportunity to observe effective teaching and assessment practice, and to gain teaching experience, over an extended period of time in two contrasting school placements. There is no consensus around the length of time that should be spent in each placement, but it

should be long enough for effective working relationships to be developed with children and young people in order to support their learning. In secondary ITE preservice teachers should obtain a broad range of experiences across the relevant age range, such as KS3 and KS4 in England (and for 11-18 courses, KS5).

Critically consider the purposes of science education, and what it means to be an educated citizen in an increasingly technological society, which may include: Discussion of past and present science curricula, in the home nation and internationally, as well as what the curriculum might look like in the future; discussion of approaches for teaching controversial/ethical issues; discussion of the importance of, and approaches to teaching about human health, sex and relationship education, children's spiritual, moral, social and cultural development, environmental education and global citizenship; and discussion of the contribution that digital technology can make to children's science education, including the use of classroom technology (such as projectors) and technology-enhanced learning.

Develop their knowledge for teaching science in the classroom and beyond the classroom, including how to represent topics so that others can understand them, using analogies, illustrations, examples, explanations, demonstrations and modelling. This should include opportunity to consider progression in children's learning across the phases for which the teacher is training, as well as gaining an understanding of those phases before and after, both theoretically and by visiting schools and colleges.

Critically consider modes of communication in science, including talking, reading and writing science, as well as the use of representations such as symbols, tables, graphs and diagrams, and the language of mathematics in science.

Develop an understanding of effective assessment in science, going beyond statutory requirements and preparation for examinations. This should include developing an understanding of effective formative feedback as part of a range of practices contributing to Assessment for Learning.

Develop 'effective reflective practice' (Loughran, 2007:1048), which may include activities such as peer observation and feedback, as well as activities that allow groups of trainee teachers to compare, contrast and evaluate their experiences in different schools, as well as activities designed to disturb their assumptions about teaching and learning in science.

Carry out 'school-based or school-focused research projects' (Rudduck, 1991:168), applying methods of educational research.

Critically consider wider 'social and political frameworks, beyond the classroom and the school, that shape the parameters of [science] education' (Rudduck,1991:164), This should include discussion of issues of social justice and science education, which may include consideration of under-representation of some groups in STEM-related careers and higher education courses.

Work in conditions which are likely to support effective teacher development, including: Opportunities to work collaboratively with other preservice teachers (both science teachers and those of other subject backgrounds); opportunities to think, talk, read and

write about teaching and learning in science; a measured introduction to practical teaching in which they are not overwhelmed by their workload; support and encouragement from science mentors, professional mentors and tutors, as well as effective feedback which recognises strengths and enables them to make progress.

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