The Evaluation of a University In-School Teacher Education Programme in Science (INSTEP)

University of Sussex

Brian Marsh

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Summary

The university In-School Teacher Education Project in Science (INSTEP) used interactive video technologies to enhance initial teacher education programmes for science trainee teachers. With four Internet Protocol[1] (IP) cameras and mounted microphones in school laboratories in six partner schools and the university teaching room, trainees and their tutors had access to live interaction with schools. This was a live feed of video and audio material, relayed from the school classrooms and reproduced on interactive whiteboards at the University. Image and sound processing software enabled users remotely to observe school classrooms and focus on particular features of pupil and teacher activity. Cameras and microphones placed at the University allowed links to function in both directions, enabling a variety of two-way interactions between teacher educators and student teachers at the University and teachers in schools.

The INSTEP technology did not simply provide a single connection to a remote classroom: it created a number of opportunities for interaction within the teacher education classroom as the student teacher became part of a network of two-way connections enabling powerful and flexible learning experiences. In the course of university-based sessions structured around the contemporaneous observation of remote classrooms through the INSTEP video and audio links, student teachers were able to interact with classroom practitioners, tutors and with their peers. This thesis presents the findings of the internal evaluation of INSTEP aimed at identifying the benefits for trainee teachers.

There has been an increase in the use of video material for teacher training purposes. However, trainee teachers are often intimidated by carefully selected extracts featuring experienced teachers. INSTEP activities are live and capitalise on all the opportunities associated with normal classroom practice. Literature points to INSTEP-type activities having the potential to enhance the development of trainees' observation skills, develop reflective thinking, to provide authentic illustrations of classroom practice, enable remote

[1] An Internet protocol camera, or IP camera, is a type of digital video camera that can send and receive data via a computer network and the Internet.

observation and facilitate the linking of theory with practice and the coaching of trainees by mentors. A fourth generation model of evaluation was undertaken with primary data generated by part-structured interviews with university tutors and mentors supported by a questionnaire and group interviews with the trainees.

The main findings point to INSTEP

1. Facilitating the link between theory and practice;
2. Enhancing and accelerating the professional knowledge of the trainee teachers through enabling reflective practice, facilitating collaborative learning and supporting the development of the language of pedagogy.

Additionally there appears to be a number of missed opportunities, e.g. the recording of lessons, the professional development and training of mentors and the use for continuing professional development in schools that may have enhanced the trainee experience further.

There are also issues arising from being an insider-researcher that are considered in this work. The research was undertaken in the context of complex relationships including:

1. Being an internal evaluator working closely with an external evaluator;
2. Role and identity duality – particularly with respect to the university tutor team.

Glossary

AfL	Assessment for Learning
CPD	Continuing Professional Development
DCSF	Department for Children, Schools and Families
DfES	Department for Education and Skills (now incorporated into DCSF)
EdD	Doctor of Education
HEI	Higher Education Institute
HMI	Her Majesty's Inspector
INSTEP	In-School Teacher Education Programme
ITE	Initial Teacher Education
PGCE	Post-Graduate Certificate of Education
QTS	Qualified Teacher Status
STEM	Science, Technology, Engineering and Mathematics
TDA	Training and Development Agency for Schools (formerly Teacher Training Agency)
TTA	Teacher Training Agency

Contents

Chapter 1 – Introduction

This research arises from the evaluation of a university In-School Teacher Education Programme in Science (INSTEP) that was sponsored by a well-known Charitable Foundation, and aimed at student teachers undertaking a Postgraduate Certificate of Education (PGCE[2]) in the teaching of science to secondary school pupils in England and Wales. Its purpose was to bring 'excellent teaching practice' to a wide audience of trainee teachers (as part of initial teacher education), experienced teachers (through continuing professional development) and other professionals; and its distinctiveness was its intention of expanding the learning capacity of the science education community by using an interactive video system (Briefing Document[3]).

The work described here comes from my internal evaluation of the project. The project was also subject to an external evaluation undertaken by a team from another university, and there was close and fruitful collaboration between these two evaluation teams. Navigating this evaluation has not been without its challenges. There has been a complexity arising from:

1. my relationship with the various stakeholders and in particular a long standing friendship with the lead tutor;
2. working alongside an external evaluation team whose priorities were determined by the external sponsor;
3. this being a technological project where the technology was continually evolving;
4. the high turnover of key mentors throughout the project.

[2] PGCE: Post-graduate Certificate in Education – this is a common route to becoming a teacher in England and Wales. PGCE programmes are normally of 1 year duration

[3] The project description and briefing document written by the tutor leading the project (hereafter referred to as the 'Briefing')

Although this thesis is shaped around the internal evaluation there is the important additional dimension of insider research which runs as a major thread throughout and is discussed at key points in the thesis.

1.1 The INSTEP Project

1.1.1 The InSTEP Infrastructure

The centrepiece of the project was a two-way fully interactive video system comprising internet protocol (IP) cameras and broadband technologies installed both in the university in partner schools.

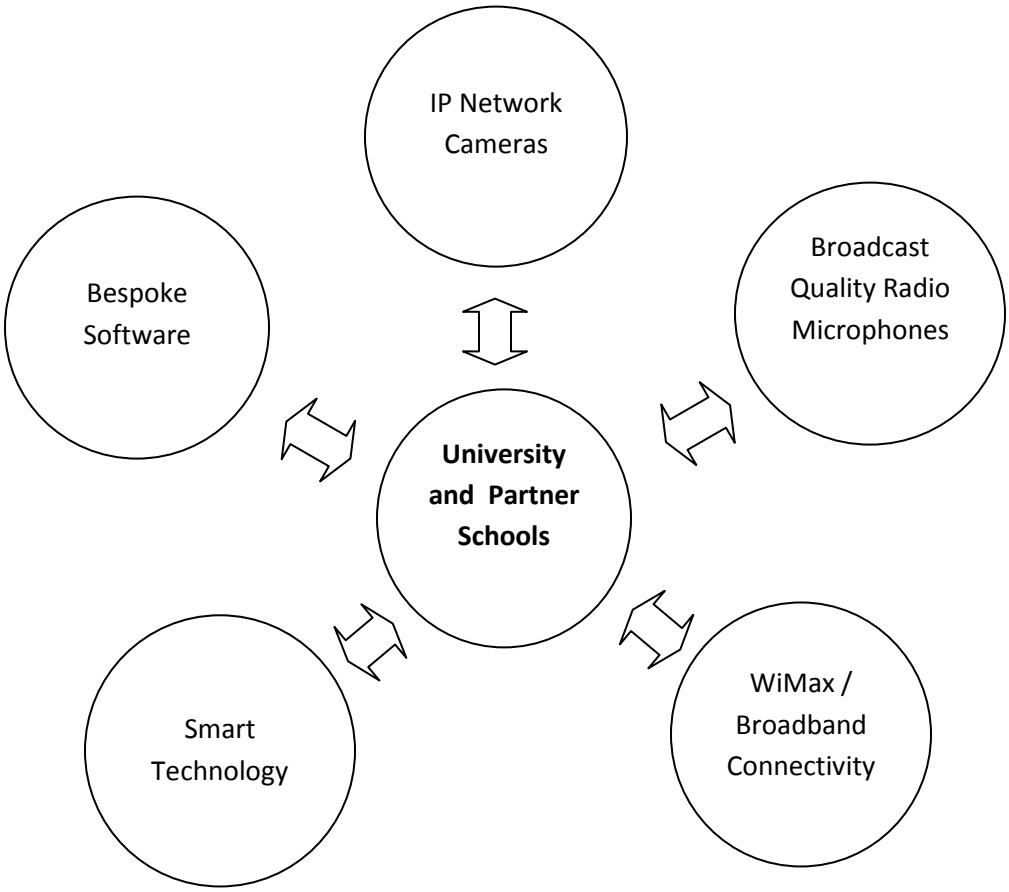

Figure 1.1 - The INSTEP Technical Infrastructure

Such an infrastructure would enable science teachers and trainee teachers to observe 'real time' classroom activities from distant sites in INSTEP equipped schools[4] and the University. These activities would be followed by subsequent live discussions. The intention stated in the INSTEP Briefing document and discussed in the main and mentor steering groups was that these activities could be recorded thus affording opportunities for both synchronous and asynchronous operation.

The INSTEP system was a safe, secure and dedicated internet link between the six partner schools and the University. Each venue had four remotely controlled I.P. cameras and microphones permanently mounted in Science rooms. Audio and video live feeds were relayed in both directions between the classroom and the university.

This configuration offered a variety of interactions to support the trainees. These included university based sessions structured around the live observation of remote classrooms in a partnership school with the possibility of the trainees being able to interact with classroom practitioners, tutors and peers. Also there were 'showcase events' involving the synchronous teaching of both trainees (in the university) and sixth formers (in a school laboratory).

[4] INSTEP equipped schools refers to those six schools in which the technology was placed enabling a dedicated live link between the school and the University and also the schools themselves.

Figure 1.2: The Split Screen View at the University

Figure 1.2 shows the four-way split screen seen by the trainees at the university. There is coverage by the cameras of a lesson being undertaken in a school laboratory in one of the partner INSTEP schools. The tutors were able to choose any one of the screens and zoom in to highlight specific issues.

A variety of interactions were possible in a university teaching session. The interactions used in INSTEP supported teaching sessions are described below in figure 1.3:

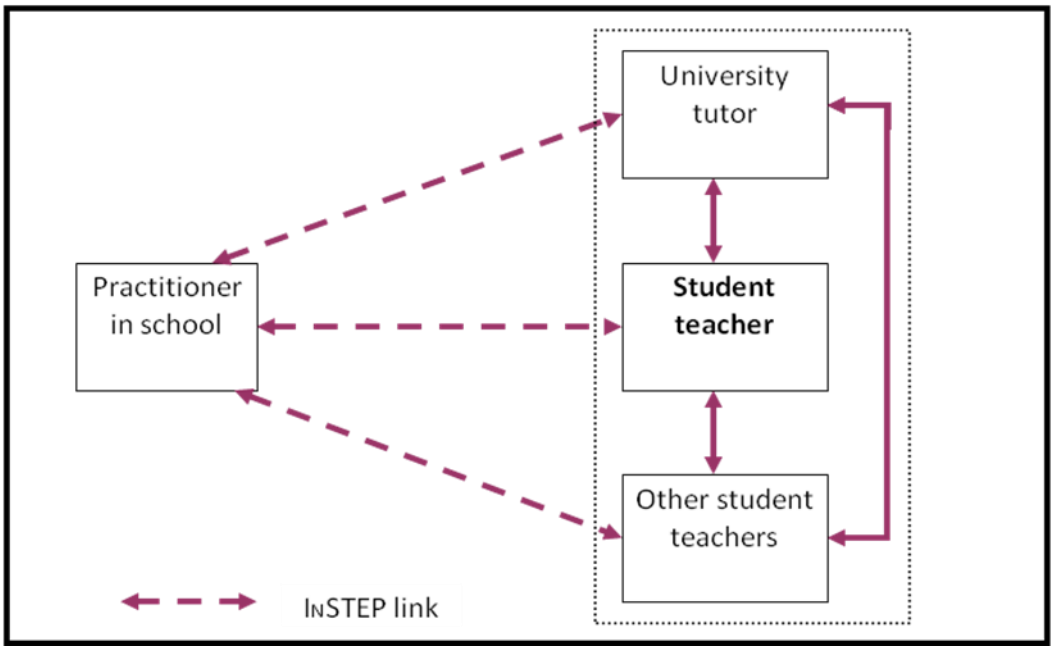

Figure 1.3: Interactions Using the INSTEP Technology

The trainees were able to observe live what was happening in a lesson in a partner school with all the features that contribute to a lesson. Supporting this was a live commentary and guided exposition from the tutor, which in turn facilitated peer discussion with the other trainees. There was the potential for subsequent discussion with the class teacher, but this was dependent upon school timings and the immediate availability of the teacher.

In the course of INSTEP sessions at the university, tutors were able to draw on contemporaneous examples of everyday, 'unscripted' classroom activity to illustrate particular aspects of teaching. They were, for example, able to comment on aspects of classroom practice that might otherwise be hard to exemplify.

Tutors were also able to make use of cameras and image manipulation software to direct student teachers' attention to particular features of the classroom activity. During such sessions, all student teachers present experienced the same examples of classroom practice at the same time. This enabled discussions informed by common experiences between student teachers to take place in the university classroom during the course of classroom observation.

Six partnership schools were involved in the project, each chosen for their expertise in a specific area of science education with the intention that this school-based expertise would be shared for both initial teacher education and the continuing professional development of more experienced teachers. The areas were cognitive acceleration[5], curriculum enrichment, independent learning, 21st Century Science[6], e-learning and mentor / peer / trainee observation. These schools also covered a wide geographical area of the university partnership: a consideration for developing satellite centres for continuing professional development.

The Briefing Document stated that the objectives of the project were to enable science teachers and trainee teachers:

1. "To observe in real time good practice of classroom activities, situated in distant sites in other schools and the university, all conducted by science teachers and student teachers as part of their PGCE programme. Rather than just being taught they would observe 'theory in action';
2. To undertake subsequent discussion of these activities with the teachers involved in order to encourage and promote reflection;
3. To access recordings of the same, and similar, activities at other times and in other places;
4. To use the INSTEP facilities in the partner schools for continuing professional development either within the school or by linking to the University or another core school." (Briefing p3)
5. "To extend the use of this new resource to Continuing Professional Development (CPD) activities in the participating schools; and to develop greater involvement of parents and governors in the science education activities of their schools and, through contact with University scientists, in science more generally" (p1).

[5] Cognitive acceleration: The partner school was using the Cognitive Acceleration through Science Education (CASE) programme which is an intervention programme developed from King's College, London, comprising 30 activities to be used within the science curriculum in years 7 & 8

[6] This is the OCR GCSE 21st Century Science suite of specifications.

It should be noted that INSTEP as an intervention was not to any real extent informed by research. It was based largely upon pragmatic or 'commonsense' considerations (Millar et al., 2006). It was, however, evaluated.

1.1.2 The Initial Development of the Project

The development of the project in year 1 provides an insight into the shaping of this initiative.

A university steering committee[7] was established and had its first meeting in September of year 1. The purpose of the steering group was stated[8] as providing a strategic overview to ensure the project remained true to its original vision. Additionally it was to set goals, provide advice and feedback and develop the work in other ways. It was anticipated that the project team would be accountable to this group. At that meeting a project plan was presented that primarily focused on the recruitment of schools rather than the strategic development of (1) the infrastructure and (2) the use of InSTEP for the professional development of trainee teachers and eventually practising teachers. It was also noted that a mentor steering group would support the development and implementation of the project.

From the outset there was significant slippage in implementing the action plan although the steering group minutes give no reason for this. The minutes of the steering committee throughout this first year point to:

1. Concerns over development of the technical infrastructure;
2. An emphasis on publicity focussing on what the expectations of the project were. Scott and Robinson (1996) warn of the danger in extolloing the merits of new technology especially as in this case it was untried and untested;
3. Issues beginning to be raised by the mentor steering group.

[7] I have seen no documents, apart from the original project bid, relating to discussion of the original ideas, the development of the bid and the establishment of the steering committee.
[8] Minutes of the initial meeting of the steering group held on 14th September 2004

It was anticipated from the project development plan that that the first two schools would be connected and live trials occurring between January to April of year 1. This did not happen until the September of year 2 where trials were undertaken simultaneously with live transmissions to support the university teaching programme. There appear to have been significant difficulties in the developing the infrastructure. Questions over technical capability during year 1 can be drawn from (1) internal email correspondence within the steering committee raising the issue for further technical support and (2) the use of a technical consultant at the beginning of year 2 – a two week consultation which resulted in him being appointed full time to support and service the project. The first live transmission in September of Year 2 only had pictures. Sound was provided through a mobile phone. This illustrates a point made by Koehler and Mishra (2008), cited in Borko et al., (2009) where innovations in technology are often distributed before they are fully tested and functional. One interesting omission is that the capability and expertise already within the School of Education for managing projects of this scale seem to have been underused.

1.2 The Context for Evaluating INSTEP

The external evaluation was independently funded by a well-known charitable foundation and began in January of Year 1. I began the internal evaluation in October of Year 2. The project paid for two years of my doctoral fees. Access was a problem for both evaluations and this made co-operation more important. However, this co-operation was seen as helpful by all stakeholders.

1.2.1 Developing the Research Questions for the Internal Evaluation

The aim for the Science PGCE course at the university is "to support their development into an effective teacher with high professional standards"[9]. However, articulating what effective teaching is or how it may be recognised is problematic. Richardson (2006, p24) suggests that quality is recognisable but, as Alsop et al. (2005) pointed out, these observed practices are diverse and highly personal. Nevertheless there are a number of elements that characterise good and effective practice for science teachers. Richardson's (2006) review of

[9] From the science mentors handbook

a number of Ofsted inspection reports identified the following features that contribute to good practice: effective planning, good subject knowledge, clear objectives, science enquiry, lively and energetic teaching, good classroom management, a variety of activities, pace, challenge, differentiation and feedback.

If the above represents the outcomes pursued by the university tutors, what are the issues pursued by the trainee teachers? Being a student teacher is a demanding personal experience that requires considerable engagement and commitment (Hobson et al., 2008). They go on to report that student teachers are concerned with their changing identity, their relationships with others and the relevance of their course provision. Student teachers have concerns both about pupils and about the learning of pupils, especially their motivation, and the pedagogical contexts within which they work (Swennen et al., 2004). Uppermost among the concerns of trainee teachers at the beginning of the PGCE programme are issues surrounding survival in the classroom (Furlong and Maynard, 1995). A longitudinal study undertaken by Burn et al., (2007) delineates the issue of 'survival' into categories reflecting the foci of learning of beginning teachers. These categories included planning, interactive teaching skills, the management of lessons, behaviour and resources, teaching strategies, contextual knowledge, self, subject knowledge and subject pedagogy.

When trainee teachers start their first teaching practice they often feel ambivalent (Hascher et al., 2004). They look forward to working and learning in their professional field, yet at the same time they may also have a fear of failure. The causes of such anxiety relate to whether they will be accepted by mentors and colleagues, and / or being misunderstood by pupils, and their dominant concerns about classroom management and pupil discipline. They are searching for strategies that will work in their new professional role.

These concerns of the trainee teachers raise a number of questions about how the INSTEP technology might be used:

1. What are the issues that the INSTEP technology is trying to solve? Can the technology be used effectively to address both the aims of the university tutor team and some of the priority needs of the trainees?

2. Can the use of the INSTEP technology significantly enhance the Initial Teacher Education (ITE) experience of the trainee science teachers and thus better prepare them for qualifying as teachers?

The purposes of this research are to identify what features of the science trainees' experience were supported by the INSTEP project and to understand how this occurred, as well as to suggest areas for further development. This thesis will therefore explore some of these issues encountered by beginning science teachers and ask "What did, and what could, the INSTEP project contribute to the development of beginning teachers?" Some consideration will also be given to two additional features that were central to the success of the project, namely:

1. The use of video technology as a training tool;
2. The management of INSTEP as a technological innovation.

My research questions are thus:

1. What impact, if any, is there of INSTEP supporting trainees through their ITE programme, preparing trainees for their placements and helping them to gain Qualified Teacher Status and become better teachers?
2. Does the use of INSTEP technology add to or detract from the role undertaken by mentors in the partner schools?
3. Can the provision of CPD be enhanced and widened as a consequence of using the INSTEP technology?

1.2.2 Pursuing the Research Questions

The challenges involved in developing and pursuing the research questions are discussed in subsequent chapters. However, it is important to note at this point that only Question 1 was properly addressed. The university tutor team gave most of their attention to their teaching of the trainee teachers.

Question 2 was compromised due to the INSTEP technology:

1. not being used for mentor development or training;
2. not being used for recording lessons;
3. only rarely being used by mentors in school for remote observation of trainee teachers.

No consideration was given to developing mentoring practices, and the apparent lack of real engagement between the university tutor team and the mentors raises issues about the asymmetric nature of the university-school partnership. Question 3 was not even attempted. Although CPD was part of the initial proposal, it was never discussed with the schools, or even with other members of the university.

Formative feedback was provided to the university tutors by both evaluation teams on regular occasions throughout the project. However, this written feedback had no effect on either their focus or their practice. This put a strain on relationships and caused me to reflexively consider how to progress the internal evaluation.

1.2.3 My Relationship To the Project

At the beginning of the project, I was (1) an experienced member of the science mentor steering committee and (2) working to complete my critical analytical study for the third component of the professional doctorate. My interest was in the role of subject leaders in schools and my intention was to pursue this for my final thesis. At the beginning of that year I became aware of the university tutors' interest in a project involving experienced teachers being observed by trainee teachers subsequently becoming aware that this involved interactive video technology. At the end of the year my school was selected as one of the first group to be connected.

Thus during the project I was:

1. The internal evaluator – this involved both undertaking the evaluation as a doctoral student and also developing a good working relationship with the external evaluators;
2. A mentor in one of the participating schools during years 1 and 2 – I was on the mentor steering committee and, as an experienced mentor, had helped to support new mentors. I was also in one of the first two schools to have connectivity and I supported some of the technical development;
3. A personal friend of two of the tutors – a friendship that spanned many years and resulted in a number of collaborative activities prior to INSTEP.

Having multiple roles and identities affords an insider-researcher perspective which is developed in various places through this thesis. However, the single focus in the direction of the project coupled with the lack of engagement of the tutor team with the evaluation process led to difficulties in my new role that I had not anticipated at the start of the research. As a result

1. only one of my three research questions could be appropriately considered;
2. a strain was placed on my relationship with the tutor team.

Chapter 2 – Literature Review

The first two sections of this review confront the issues involved in training prospective science teachers in general, while the second two sections are specific to the introduction of the INSTEP Project in particular:

1. What should a beginning teacher know?
2. The professional learning of beginning teachers
3. The potential role of video technology;
4. Other factors that could affect the effective implementation of this programme

2.1 What should a beginning teacher know?

In teacher education there is more urgency about 'what to do' than about 'why' trainee teachers should do it (Ovens, 2000). One significant consequence is that trainee teachers look for immediate and pragmatic solutions. Alsop et al., (2005b) argue that locating the specifics of teaching within some broader theoretical framework should be fundamental to the development of teachers. However, Bishop and Denley (2007) point out that, although a number of attempts to define the knowledge required for teaching have been made, discussions of what a trainee teacher should know are now situated within a policy context driven by a competency framework for teacher capability on the one hand and the National Strategies[10] on the other. Few diversions from national frameworks are possible in programmes as busy as a PGCE.

[10] The National Strategies are professional development programmes for early years, primary and secondary school teachers, practitioners and managers. They are one of the Government's principal vehicles for improving the quality of learning and teaching in schools and early years' settings and raising standards of attainment. Details of materials are found at http://nationalstrategies.standards.dcsf.gov.uk/ (accessed 30th May 2009)

2.1.1 Types of Knowledge

The foundation for career long learning is established during the earliest stages of a teacher's formation, that is through their training as a student and their first two years after qualification. Beginning teachers need to acquire knowledge, skills and understanding as well as to learn how to critically evaluate and improve their own practice during the period of initial teacher education. However problematising what beginning teachers need to know raises a number of issues and questions. National policy looks at knowledge and expertise in terms of competence and capability (TTA, 2004) yet this omits consideration of the place of educational theory. Subject knowledge and pedagogical content knowledge were left implicit at the time of my evaluation, but were made more explicit in later revisions of the National Standards (TDA, 2007a, TDA, 2007b).

At the heart of the debate are questions about the nature of knowledge and the effects of different kinds of knowledge on teachers and teaching **(**Loughran**,** 2006**)**. Part of the debate surrounds the relationship, and perceived value, of the formal knowledge of teaching (often seen as the province of the Higher Education Institute, HEI) and the practical knowledge of teaching (as created by teachers through their classroom experiences). Teachers in schools put forward their everyday practice and demonstrate the complex and usually tacit knowledge that informs it; but it is also important to note that an appropriate knowledge base of facts, principles and experience is essential for underpinning and justifying the choices and actions they are making. Consequently teacher education is not about indoctrination into set ways of working but about education in how to reason soundly about one's teaching, so that teachers can practice in a skilful manner (Shulman, 1987). What Shulman recognised was that if teachers are to be effective practitioners they need both an in-depth knowledge of their subject and a comprehensive knowledge and understanding of how to represent this subject knowledge to learners.

Shulman (1987, p8) describes seven categories in what he calls a teachers' knowledge base:

1. Content knowledge;
2. General pedagogic knowledge;
3. Curriculum knowledge;

4. Pedagogical content knowledge;
5. Knowledge about the learners;
6. Knowledge of educational contexts;
7. Knowledge of educational ends, purposes and values.

One benefit of Shulman's (1987) thinking is that it offers an opportunity to identify those aspects of knowledge required by a teacher, particularly pedagogical content knowledge. Unsurprisingly this finds currency amongst those involved in initial teacher education. Kind and Taber (2005), Bishop and Denley (2007), Wellington and Ireson (2008) and Kerfoot (2009) all see this as important in identifying high quality teaching.

Pedagogical content knowledge incorporates how teachers interpret and transform subject knowledge in the context of supporting pupil learning (Van Driel et al., 1998). It encompasses an understanding of common learning difficulties and pupil misconceptions. Subject content knowledge is brought to the classroom whereas pedagogic content knowledge is developed and learned from classroom experience. The two interact and inform each other.

> "Pedagogical content knowledge is what allows for the meaningful blending of content and pedagogy for teaching" (Segall, 2004, p2)

Trainee teachers have very limited pedagogical knowledge but rapidly acquire it. They do so through observation and discussion of other teachers' practices (Hagger and McIntyre, 2006), collaborative planning and teaching, and focussed support and evaluative feedback on their planning and teaching from teachers in their placement schools (Burn, 2007). Early career professional learning is characterised by the accumulation of experience, although not all of it is consciously processed (Eraut, 2007b). Moreover as pedagogical knowledge increases, so does the understanding of subject content knowledge (Wellington and Ireson, 2008). The usefulness of this framework is that it begins to outline those factors that teachers need to develop.

Whilst there is no universally accepted consensus about which knowledge components are included, the notion of pedagogical content knowledge provides a valuable framework for the discussion of teachers' knowledge and their decision making because it focuses attention on subject specific knowledge, as well as other categories of knowledge used by teachers (Burn, 2007, Segall, 2004). Pedagogical content knowledge refers to particular topics and differs from subject knowledge per se, because it is context dependent (Van Driel et al., 2002, Loughran et al., 2004). It is an aspect of teachers' practical or craft knowledge (Burn, 2007) and trainee teachers learn it from the activities of the experienced teachers with whom they work in their placement schools. These include observation and discussion of an experienced teacher's practice (Hagger and McIntyre, 2006), collaborative planning and teaching, and evaluative feedback and focussed support on the trainee teacher's own emerging practice.

However, there are difficulties for trainees seeking to develop pedagogical content knowledge:

1. Kerfoot (2009), for example, suggests that pedagogical content knowledge is the most demanding to acquire and is only developed over a period of years;
2. Loughran et al., (2004) note that it is a difficult process to both recognise and articulate. It is an internal construct that is complex and tacit, and time is rarely provided in schools for discussions that enable teachers to describe their tacit professional knowledge in articulated forms;
3. Carlsen (2001), building on Shulman's work, suggests that these domains of teacher knowledge support consideration of questions such as 'How might a Biology teacher's knowledge differ from that of a biologist?'
4. Shulman fails to identify which aspects of a teacher's knowledge base are codified and which are implicit.

Although Shulman's (1987) typology is useful in identifying those components that comprise a teacher's knowledge base, he does not comment upon how that knowledge is acquired. Hall and Andriani, (2003) suggest that tacit knowledge is acquired by experience, the knowledge of what works, and is characterised by causal ambiguity. Eraut (2007b)

argues that there is a large tacit dimension in professional knowledge, which includes routines and understanding the situation, both in preparation and when responding to classroom events.

Another attempt to develop a model of what a teacher needs to teach science is described in terms of knowledge skills and understanding (Frost, 2005):

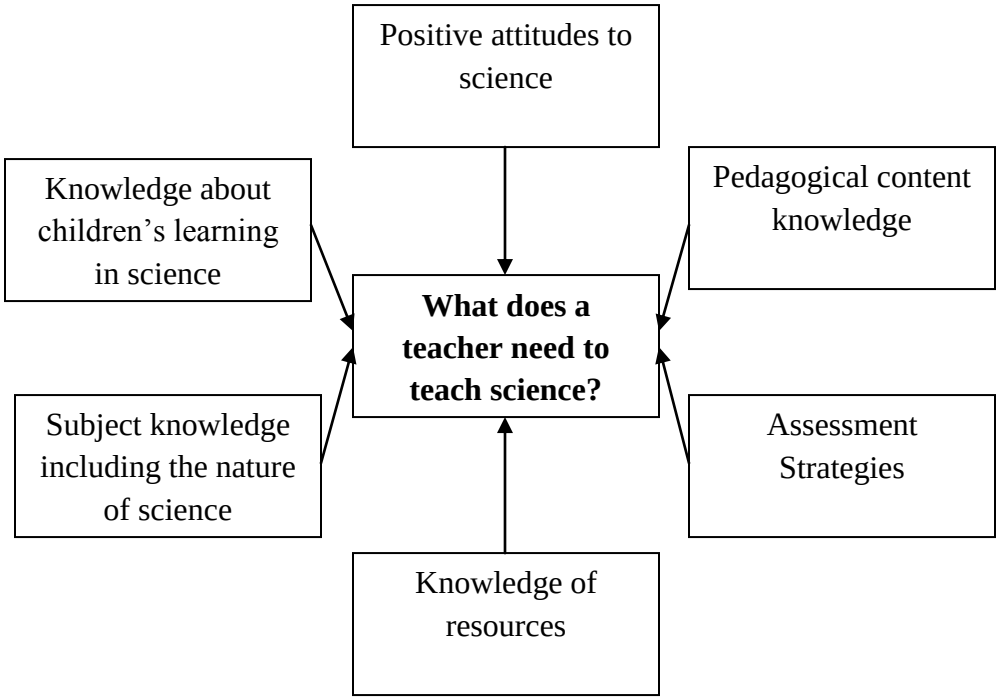

Figure 2.1: What does a teacher need to know to teach science? (adapted from Frost, 2005)

An important feature of this model is that it includes dimensions of the teachers' own learning experiences, which are essential for understanding how pupils learn. The government emphasis on competencies alone, however, fails to reflect the complexity and pragmatism of effective practice. Thus Alsop et al (2005) note that what counts as successful teaching is now defined by policy in quantified terms that are somewhat divorced from the complexities and intricacies of the classroom. The important issues here are (1) the difference between a holistic performance incorporating a number of competences in appropriate ways, and (2) the variations of both the levels of individual pupils and the nature of the class climate on any particular day.

2.1.2 Problematising teaching

The INSTEP project team stated that their technology would be used to exemplify 'best practice in school based science teaching' (Key Messages[11], p1). This statement, made without any clarification or qualification, was predicated on the understanding that both the tutor team and school based mentors knew what 'best practice' meant. This begs a number of questions such as 'what is it', 'what do teachers do' and 'how will the trainees benefit from this'.

Coffield and Edward (2009) note that the concept of 'best practice' is contingent on the professional judgement of particular individuals in particular settings. What counts as 'good' or 'best' practice varies from one situation to another and from one expert to another. Thus Alsop et al. (2005) wrote about exemplary teaching, Richardson (2006) related good practice to producing good pupil outcomes, and Hagger and McIntyre (2006) took the pragmatic view of good practice being understood as what demonstrably works.

If the members of the INSTEP project team had tried to amplify their understanding of 'best practice' they would have realised that different schools had different views, i.e. that a single definition of 'best practice' was problematic. Alsop et al. (2005) argued that such practices are diverse and highly personal. (Hagger and McIntyre, 2006) agreed that there is great diversity in good practice, but argued that it still involves expert pedagogical thinking and the effective use of professional craft knowledge. While it is not possible to reduce teaching to a set of laws, there is a high consensus amongst teachers about the need to optimise pupils' learning and produce good pupil outcomes (Hagger and McIntyre, 2006, Richardson, 2006). Hopkins (2005) added that effective teaching also relies on establishing and sustaining high quality relationships with pupils, including teachers' commitment to and high expectations of pupils as individuals.

Alsop et al., (2005) collected a diverse series of narrative accounts of exemplary science teaching, and concluded both that teaching is complex, multi-faceted and messy and that

[11] A report to the charitable foundation outlining key messages from the project written by two project tutors (hereafter referred to as 'Key Messages'.

exemplary practices are diverse, highly personal and contextualised. Trying to describe a single vision of such practice is problematic. The pedagogy of teachers, both experienced and just beginning, is influenced by their beliefs about teaching, learning and assessment (Brown, 2004). Their values and beliefs are derived from personal experiences, including those associated with trainee teachers' subject discipline and those derived from learning contexts prior to commencing the ITE programme. Moreover, values can be adopted or reinforced by strong departmental cultures (Winterbottom et al., 2008).

Nevertheless some relevant statements can be made. Teaching is undertaken to bring about learning, and is therefore an intentional activity (Carr, 2002). It begins with a teacher's understanding of what is to be learned and how it should be taught. But it involves much more than the transmission of knowledge, because it has to develop both learner engagement (Shulman, 1987, Taber, 2005) and the facilitation of learning (Taber, 2005). Teaching and learning are inextricably linked.

Nevertheless, teaching is more often than not described in terms of what teachers do rather than how different learners respond to it. Hey McBer's (2000) research into teacher effectiveness talks in terms of micro-behaviours that effective teachers exhibit when teaching a class. Ofsted criteria are expressed in terms of aspects of good practice (Richardson, 2006).

Alsop et al., (2005) suggest that the subtleties of teaching defy analysis but what can be achieved is the illumination of practice. Their comments are based on the difficulty of understanding what reasoning underpins a science teacher's practice and why a science teacher chooses one strategy for some concepts but not for others. Learning to teach is complex and multidimensional (Hagger et al., 2008). There are different types of things to learn and different processes to engage in. Wallace (2005), however, suggests that there are some common facets to high quality teaching. These include:

1. A clear understanding of the teacher's own role in the teaching / learning process. The teacher has responsibility for setting broad goals, determining the activities to be used, scaffolding the learning and assessing the outcomes;
2. Recognising the importance of preparing activities designed to promote learning. Effective teaching responds to the different ways pupils learn (Taber, 2005);
3. The centrality of subject content knowledge;
4. The plurality of pedagogy where a wide range of pedagogical techniques are employed.

Ayres et al.'s (2004) study in New South Wales, Australia, categorised effective teachers as being those who provided highly structured teacher led lessons, yet facilitated independent pupil work. This involved developing strategies to promote higher-level thinking. What Ayres et al. (2004) also reported is that novice teachers were less effective during interactive teaching, because they had not yet learned how to use pupil responses as springboards for further discussion.

With such complexity, it is not surprising that the discourse of government policy on teacher education, for the most part, has been in terms of 'competences', 'skills' and 'outcomes' (Arthur et al., 1997). The focus of attention is on what a teacher can do, as opposed to what a teacher is and can become. These then become the definitions of standards (Shulman, 1987). However in a study exploring the learning of beginning teachers (in particular reasons put forward for teaching decisions and their subsequent evaluation), trainees showed a high level of concern for pupil learning and a surprisingly sophisticated grasp of the complexity of teaching (Burn et al., 2000). There appears to be a divergence between policy discourse and trainee practice.

2.1.3 National policies for teacher education

Reynolds (1999) argues that the starting point for the current approach to teacher training began in 1993 with the introduction of national competencies. These were changed to *national standards* in 1997; a "benchmark of acceptable practice" making "professional requirements unambiguous" (Reynolds, 1999, p2). Thus outcomes-driven professional

practice was already settled by the project period of 2004 -7; and teaching was framed in an essentially pragmatic context. However, the requirement that Initial Teacher Training providers focus on competencies or 'standards' for teaching does not preclude the facilitation of the trainee teachers' pedagogical understanding (Hobson, 2003). Thus providers working within such a framework also need to assist trainee teachers to develop some theoretical understanding of their practice.

2.1.4 Educational theory[12]

Driver (1996) argued that developing quality in science teaching is based upon knowing both what we do and why we do it. Engaging with these questions enables some conceptualisation of the job of teaching science. Wellington (2000) suggests that the role of theory is to help and understand events; while Smith and Hodson (2010, p.261) argue that theory helps trainee teachers to understand "why things are as they are" since the value of theory is to afford ways of making sense of practice (Korthagen, 2007). Theories may be used in the form of a metaphor, model or framework, and their purpose is to explain phenomena and provide a new way of helping to make sense of things that happen in lessons at school or university. Wilson (2009) writes of explicit, codified knowledge that includes, "research based literature of well grounded propositions which have the potential to be highly applicable in the classroom" (p4) and contrasts this with the implicit tacit knowledge used by teachers in the classroom and expressed through action-based skills.

Hobson (2003) describes beginning teachers' views on 'theory' as not being well conceptualised. They associate 'theory' with those aspects of the course undertaken at university. However theory also has an important role in reflecting upon and explaining practice, and professional studies form part of an HEI's contribution to initial teacher education. Eraut (1994**,** p60) argues that Educational Theory comprises:

> "concepts and frameworks, ideas and principles which may be used to interpret, explain or judge intentions, actions and experiences in educational or education-related settings"

[12] My use of educational theory is based on this section. The word 'theory' is used with different meanings by some of the university tutors, and this will be identified in footnotes at the appropriate point e.g. p100.

In practice, however, many studies show that many trainee teachers are sceptical of the value and relevance of the theoretical aspects of ITE and thus fail to make connections between educational theory and practical teaching (Hobson, 2003, Hobson et al., 2006). Roth and Tobin (2001) argue that this gap between the knowledge and theory from university courses and the lived experience of everyday classroom activity is unavoidable. Thus Braund (2010) adds that closing the gap between theoretical, propositional knowledge and the often tacit professional craft knowledge is one of the major challenges for teacher educators. McIntyre (2005) while arguing that there is a perceived gap between codified research-based knowledge and the practice knowledge of teachers goes on to say that these types of knowledge are at opposite ends of a spectrum (figure 2:2), they are mutually complementary.

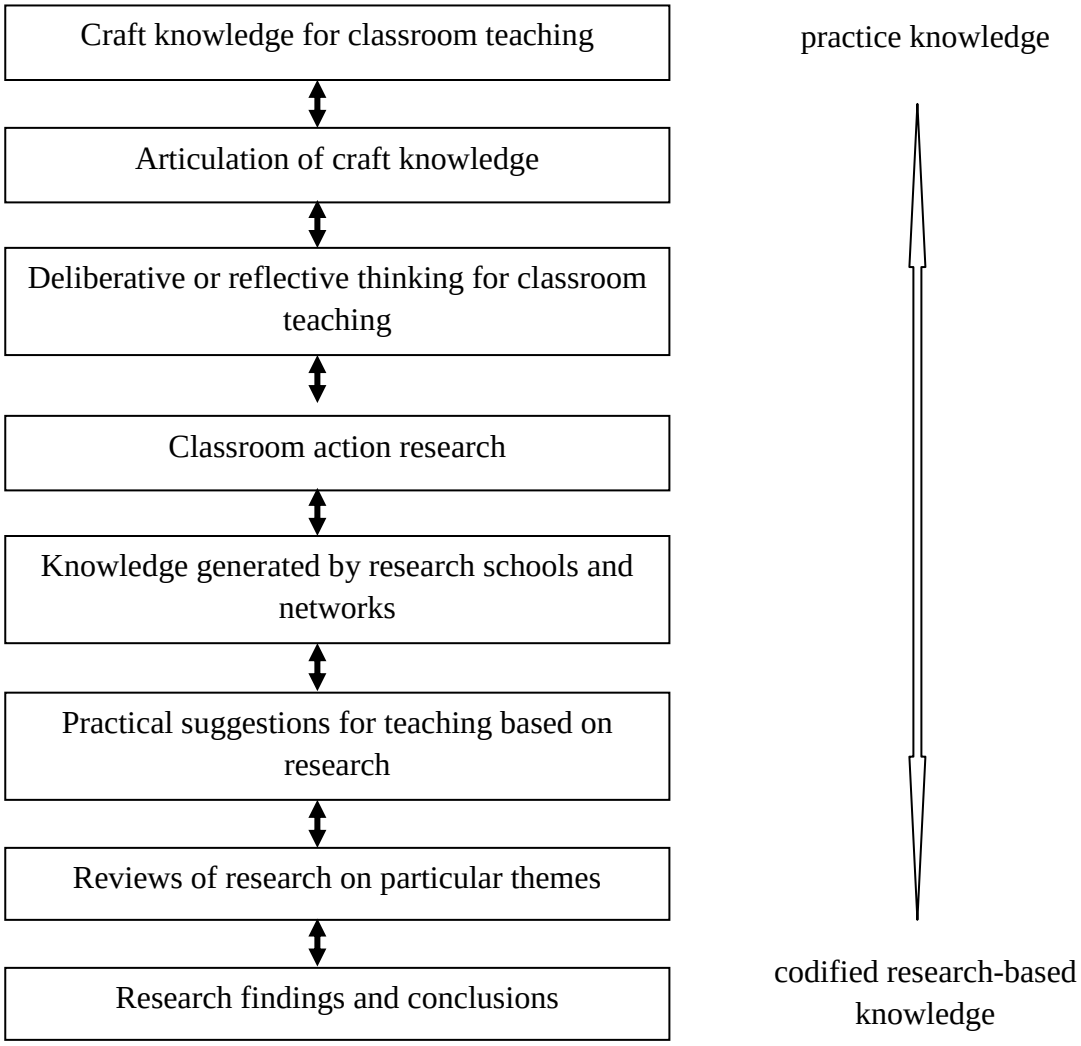

Figure 2:2 Practice / research-based continuum (McIntyre, 2005, p361)

Jones et al., (1997) argue that day to day classroom practice and educational theory do not stand in opposition but should be held together, even though their relationship is complex. McIntyre (2005) makes the point that research based knowledge is not easy to use by teachers as they often have to make quick decisions in the complexity of the classroom – decisions that draw upon tacit knowledge. Korthagen (2007) writes that teachers need action-guiding knowledge in situations where they have little time to think. This is "rather different from the more abstract, systematised and general expert-knowledge researchers develop" (p306). This corresponds with Eraut (1994) who writes that theory "rarely gets just taken off the shelf and applied without undergoing some transformation" (p157). Closing this gap requires time and energy to explore the relationships between them.

Korthagen (2007) notes that beginning teachers start with a framework of meaning-making and decision-making based upon beliefs about teaching and learning acquired from their experiences as pupils; and these preconceptions are very resistant to change. The alternative involves understanding the complexity of teaching and recognising that teachers are expected to accomplish complex and sometimes conflicting goals. It takes considerable time to learn how the curriculum can best be handled in a particular context and how to respond to pupils at any given time. This connects with Hargreaves' (1998) emphasis on the emotional dimension of teaching, when he argues that teaching is a profession in which emotions and feelings play a central role, but are undervalued when considering professional formation and the subsequent implications for practice.

Hobson[13] et al. (2009) noted that trainee teachers are primarily concerned with practical problems such as behaviour management and acceptance by experienced teachers in the profession, rather than theoretical issues which appear to be less directly related to the 'front-stage' work of the teacher. In one study, Hagger et al., (2008) identified a group of trainees who assumed that experience would automatically lead to learning, because their lessons were seen as putting 'miles on the clock'. However, they also pointed out that there is a limit to learning from only accumulated practice. Hobson (2003) describes such

[13] Details of this Department for Education and Skills project can be found at www.becoming-a-teacher.ac.uk (accessed July 2009)

trainees as procedural[14] apprentices whose primary concern is to be given strategies and procedures to use in the classroom. Hagger et al., (2008) contrasted this group with another very different group, who looked for opportunities to develop their thinking and practice by drawing upon the expertise of their tutors, mentors, research and scholarship. What Hagger et al., (2008) and Hobson (2003) describe is a rationale for the perceived importance of theory.

Becoming a good teacher requires not only practice but professional learning that fosters more advanced theoretical knowledge (Hascher et al., 2004). Thus a framework is needed to bridge the theory-practice divide (Alsop et al., 2005). Although this framework is theoretical, it helps to ask the right questions about practice and classroom events and to make the implicit more explicit. Suggested frameworks include notions of social constructivism and communities of practice (Korthagen, 2007) alongside reflection-on-action and group discussion of observed practice (Sweeney, 2003). Exemplary science practice does not happen by accident or in the absence of research on teaching and learning.

Hobson et al. (2009) suggest two ways in which trainee teachers might approach theory. The first is to see theories as potential explanations of events that occur in the classroom. A second approach is to see theories as tools that are helpful in planning and reviewing teaching. Theoretical and practical ideas are developed in both university and placement settings. However, the differences in culture and context makes the transfer of knowledge from the educational setting to the workplace (i.e. placement setting) particularly difficult (Eraut, 2004a).

2.1.5 Subject knowledge

If teachers are to be effective practitioners, they need both an in-depth knowledge of their subject and a comprehensive knowledge of how to communicate the subject matter to pupils (McCarthy and Youens, 2005). However, science is made up of a range of distinct disciplines, each with its own ways of workings (Kuhn, 1977) and learning in physics is very different from learning in biology. Science graduates are not a homogeneous group

[14] Hobson (2003) actually uses the phrase 'proceduralist' apprentice to describe those trainee teachers who want to know what to do in school but are not concerned with why.

(Kind and Taber, 2005) and teachers in the secondary phase are often asked to teach science in areas outside their subject specialism (Richardson, 2006). Degrees in Biology, Chemistry and Physics provide detailed knowledge about a particular field within science, so most trainee teachers are not well prepared for work across the secondary science curriculum, particularly at Key Stage 4. Nevertheless the standards for the award of qualified teacher status (QTS) (TTA, 2004, TDA, 2007a) require trainees to know enough science to be able to teach all the sciences at Key Stage 3 and one science specialism at Key Stage 4. However in practice, nearly all teachers have to teach outside their specialism at Key Stage 4 throughout their career. The problems encountered include having little knowledge of potential pupil problems and misconceptions, and the selection of appropriate pedagogies. Moreover, teachers outside their main specialist area tend to talk longer, express more personal misconceptions and pose questions at a lower cognitive level (Van Driel et al., 1998).

2.2 The Professional Learning of Beginning Teachers

Formal representations of professional knowledge are highly problematic (Eraut, 2007a). For teachers there appear to be two competing discourses. The first is focused around competence and competency statements, and the second is concerned with experts and expertise.

The professional learning of trainee science teachers involves the study of real practical problems in genuine contexts in order to enhance the interaction of theory and practice throughout the learning process (Ovens, 2000). This development occurs through reflective practice, collaborative learning and acquiring pedagogic language (Bishop and Denley, 2007), and also helps trainees to conceptualise what it means to become a teacher (Wellington and Ireson, 2008).

Although trainee teachers learn from observing other teachers at work, most of their practical knowledge is constructed through experience (Eraut, 1994). Trainee teachers learn from experiencing the processes of planning, teaching and evaluation, as the early problems they encounter force them to reflect and rapidly adjust their behaviour. It is in these

processes that educational theory may be introduced to aid understanding (Burn et al., 2007). Teaching requires the application of knowledge, interpretation of experience and application to future situations through using critical thinking and previous experiences (Harrison et al., 2005). The often implicit beliefs held by teachers about teaching and learning have a major influence upon their classroom practice (Van Driel et al., 1998); but they also have to reflect on what has just happened in the classroom and why. The guidance they receive from mentors, HEI tutors and literature will normally be a mixture of practical principles (Hirst, 1985) and feedback on aspects of their lessons and assignments.

How trainee teachers develop is subject to debate. Furlong and Maynard (1995) suggest that trainee teachers move in distinct stages from a pre-occupation with self, to developing competence and overcoming problems, to engagement with pupil learning and classroom practice. However, they appear to choose examples that fit the stages rather than examples of people in transition. Thus Winterbottom et al. (2008) argue that a number of studies show this to be a fluid process rather than a set of discrete stages, with progression rates being differentiated according to the individual concerned.

2.2.1 Reflective Practice

Wellington and Ireson (2008) view the effective teacher as a reflective practitioner who is capable of reflection and analysis of their own practice (Schön, 1987) this resonating with teaching because it encapsulates the complexity of teaching and learning at a time when teachers are being treated as technicians. Whilst this is true for university teachers and some mentors (Hagger et al., 2008), being a reflective practitioner is not necessarily true for beginning teachers.

Schön speaks of teachers possessing a type of knowledge called 'knowing in action', which has a strong tacit dimension. Although knowledge cannot be made fully explicit, it can enable experienced teachers to develop by *reflection in action* during the actual practice of teaching, as well as engage in *reflection on action* when considering unplanned critical incidents some time after they occurred. Both types of reflection should be built into a teacher's practice. However, reflective practitioners have a variety of perspectives (Parsons

and Stephenson, 2005) and there is no consensus as to what constitutes reflective practice (Hagger et al., 2008).

Eraut (1995) treats Schön's *reflection-in-action* as a process of knowledge creation rather than knowledge-in-action, because classrooms are dynamic, often unpredictable contexts; so new and/or partly new responses have to be invented. Reflection-in-action entails the reading of a particular situation followed by a rapid and intuitive response, and this kind of expertise requires both a great deal of prior experience of similar situations and some knowledge of the group of people involved. This is very difficult for trainee teachers, even when they are able to observe good role models; but the use of *reflection-on-action* is less problematic. Attempting to make retrospective sense of an action and learning something from the experience contributes to the extension of one's knowledge base.

If there are difficulties for trainee teachers with the notion of pedagogical content knowledge so there are also difficulties for them with reflective practice. Hagger et al., (2008) builds on McIntyre's (1993) argument that beginning teachers are more engaged in theorising rather than reflection. Hagger and McIntyre (2006) describe this in terms of learning from other people's ideas whether it be an experienced practitioner or educational researcher. They are engaged in conscious deliberation with many aspects of their practice yet to be developed. These difficulties are noted elsewhere. Eraut (1995) lists the availability of time to reflect, disposition to reflect and the routinisation of professional work as militating against the process of reflection and Tomlinson (1999) reports that a large number of trainee teachers exhibit an antipathy towards deliberate reflection.

2.2.2 Collaborative Learning

Although the university staff and the partnership school staff interact with each other, particularly when discussing outcomes for trainee teachers, their contexts and responsibilities are quite distinct. Nevertheless it is within and across these communities that the learning of trainee teachers is shaped. Schepens et al., (2007) suggest that, during the period of initial teacher training, the trainees' learning processes are subject to four groups of interacting factors:

(1) Issues of identity such as personality, their previous experiences of learning and how they are perceived by other colleagues and pupils;
(2) The demands of Higher Education Institutes (HEIs) and the Training and Development Agency for Schools (TDA);
(3) The responsibilities, welcome and demands of the placement schools;
(4) The context of the placement schools and HEI (the type of school and partnership relationship).

Hascher et al. (2004) consider the challenge posed by the two communities trying to effectively work together for the benefit of their trainee teachers. In many initial teacher education programmes the university monitors the practice but responsibility for the practice is handed over to the mentors in the partnership schools. This is not unreasonable because that practice is mainly shaped by the school reality but it has important implications for partnership and mentor training.

Universities offer opportunities for trainee learning in assessment, pedagogy, children's learning (Ambrose, 1996) and the development of subject knowledge. The partner schools provided opportunity for work-based learning where school teachers (especially the trainee's mentor) take on the role of school-based teacher educators (Boyd et al., 2005). This practice knowledge is often complex, partly tacit and embedded in the everyday practice of teachers (Burn, 2007), a component of which is pedagogical content knowledge which she argues for student teachers can ultimately only be created in practice.

Empirical evidence from a study of mentors and trainee teachers undertaken by Williams and Soares (2000) found that a strong HEI contribution to initial teacher education is critically important to the practice of teaching. HEI's are the centre of expertise to support schools (Pring, 1996). They provide analyses of the processes of learning, provide access to relevant research and integrate practice with theoretical reflection on that practice. They provide access to significant areas of expertise that schools do not have (Williams and Soares, 2000). This expertise is important for trainee development, the professional development of school-based mentors and the development of teaching as a research based

profession. Additionally HEIs are involved in developments of subject methodology and provide schools with access to the wider trends of curriculum development and educational management (Downes, 1996).

An important role of the university tutor is to expose the craft of teaching to a more analytical scrutiny (Braund, 2010). Thus Burns (2007) writes that university tutors, by virtue of their role and context, provide propositional knowledge about effective teaching practices. They link literature with practice whereas mentors and professional tutors introduce and support trainees in school contexts. As practising teachers they offer an insight into 'professional craft knowledge' (Brown and McIntyre, 1993) by demonstrating the complex and often tacit knowledge that is embedded in their everyday practice, providing trainees with appropriately challenging work and giving them feedback to assist their progress.

Acquiring the skills necessary to transform a teacher from novice to expert requires the involvement of a mentor or coach who can help bridge the gap between theory and practice and highlight some of the tacit and hidden knowledge (Harrison et al., 2005). Working alongside experienced teachers allows the trainee to observe, listen and participate in activities. In doing so they learn new practices and perspectives, become aware of different types of knowledge and expertise and gain some insight into experienced teachers' tacit knowledge (Eraut, 2007b). Beginning teachers learn from experienced practitioners and develop their own practices as they struggle to apply their technical knowledge and use reflection to make sense of their experience. Although they might lack the extensive repertoire of their mentor, they can still exhibit the desire to think, consult and enquire about their practice. Younger et al. (2004) emphasised the importance of experienced teachers within a trainee's placement school as follows:

> "these teachers are influential models, acting as important formative influences on the development of the trainees' emergent practices" (p251).

The beginning teacher needs access to critical discourses and research as well as opportunities for assimilation and critical reflection; and this is a major function of the

university. As Hobson (2003) notes, it is here that the principles behind teaching and learning are developed. He goes on to argue that there are a number of sources of evidence which suggest that embracing the theoretical knowledge which underpins practice supports both the initial learning of beginning teachers and their subsequent professional development. As Furlong and Maynard (1995) argue, becoming an effective teacher is not just following the routines of others but requires a deep understanding of the processes involved in teaching and learning.

The roles teachers take in and around the formal school setting can be major factors in the professional lives of teachers, particularly trainee teachers. This is because teaching is a social practice embedded in a specific social setting and it is here that knowledge is constructed, communicated and validated (Park et al., 2007). Teachers expand their repertoire of context specific knowledge through social interaction, negotiation and co-construction of meaning. Barnett and Hodson (2000) indicate that teachers new to the profession are progressively enculturated into the knowledge, beliefs, attitudes, values and codes of behaviour in a teacher community. They develop a collective teacher knowledge that could be regarded as professional theorising. However it is worth noting that teachers in schools do not always have access to research (Landrum et al., 2002); and the practice that trainee teachers encounter is more likely to be mediated by school and department policies, which themselves are influenced by government policy and inspections.

Park et al., (2007), however, point out two areas to watch. First, the lack of a professional tradition for sharing expertise and articulating professional knowledge creates a culture of isolationism. The description of teachers being isolated artisans who tinker around with their practice (Hargreaves, 1992) characterises this culture. The second point of caution (Park et al., 2007) is the view that trainee teachers are mainly concerned with pupil behaviour, managing activities and task completion rather than being focussed on pupil learning. Classroom observation is of particular importance to the trainee because observing the ‘good practice’ of experienced teachers is of great value. However, it has been recognised that the more skilful the teaching, the easier everything looks, and the more difficult it is to understand how success is achieved (McAlpine et al., 1988).

2.2.3 The Role of the Mentor

The school placement has assumed a position of major importance in the professional development of teachers (Hagger et al., 2008, Hobson, 2003) in that it provides classroom experiences, supports the evaluation of the trainee's teaching ability and encourages socialisation into the profession (Hascher et al., 2004).

Within the school, teacher mentors play an important role in the development of the beginning teacher. They have some formal involvement in the supervision, training and assessment of beginning teachers (Saunders et al., 1995). They have responsibility for (1) advising trainee teachers how to teach particular subjects, (2) developing their trainee teacher's understanding of how pupils learn (and thus how learning can be planned) and (3) giving advice on behaviour management and assessment (Cohen et al., 2004). Burn (2007) argues that knowledge creation by trainee teachers comes from both interactions of explicit knowledge (often discussed in research and professional literature within the university) and from tacit knowledge embedded in the mentors' contextualised practice. There is, however, an issue of consistency of experience between the trainee teachers due to the differing school contexts and the differing qualities of mentors.

The role of the mentor is complex, multifaceted and developmental because the trainee's needs change throughout their school placements (Gujral, 2005). This role is seen as being most effective when it incorporates such practical help as providing guidance, giving feedback from observed lessons and developing the trainee teachers' understanding of good practice (Jones et al., 1997). This understanding comes through the trainee's personal reflections on practice, so trainees need to be challenged to evaluate their own thinking. Mentors, however, appear to have profound difficulties in undertaking this task (Maynard, 1996), perhaps because teachers rarely challenge their colleagues' thinking.

Some of the skills required by mentors include being a model of good teaching practice, empathy, developing observation skills in ways that crystallise specific issues for discussion and the ability to review, reflect, assess and appraise their trainee's performance (Cohen et al., 2004, Wright and Bottery, 1997). In addition effective mentors provide

encouragement and support the trainee teacher in managing their time (Jones et al., 1997). Whitehead and Fitzgerald (2007) describe the mentor-trainee relationship as being a top-down model where beginning teachers are inducted into an agreed body of professional knowledge linked to externally prescribed competencies. However, mentors find it difficult to talk about the knowledge that underpins their practices, as their knowledge is often heavily situated in the context of that practice (Edwards and Protheroe, 2003). This point is developed by Eraut (2007b) who reports that mid-career teachers have converted explicit routines (at the beginning of their career) into tacit routines following several years of experience, thus making it difficult to explain their skills to trainee teachers.

Several models theorising the role of the mentor have been proposed, from which I have chosen to discuss two: those of Rice (2008) and Furlong & Maynard (1995). Both models contribute to our understanding of the mentor role.

Rice's (2008) model emphasises the process for training the student teacher with particular reference to the mentor's contribution.

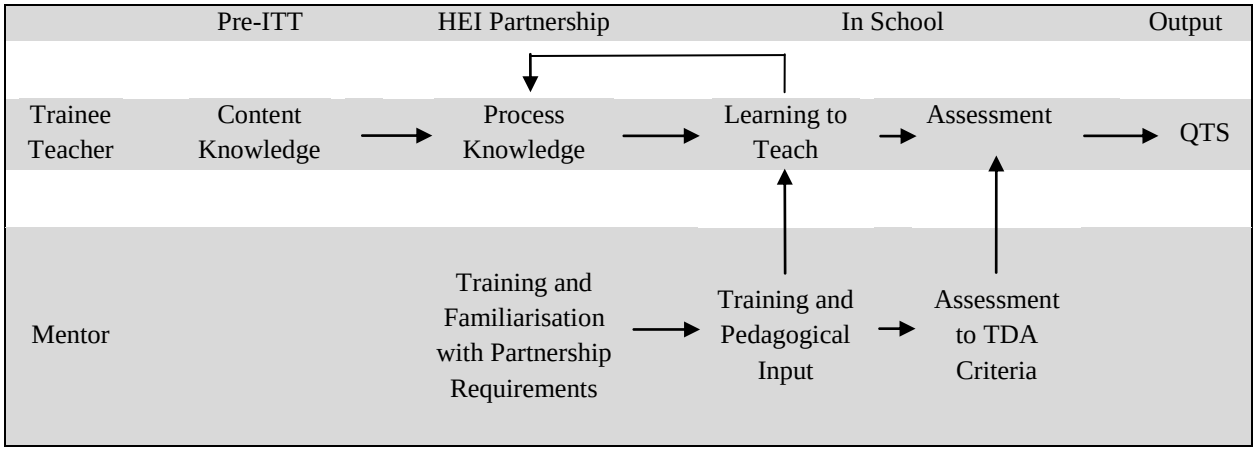

Figure 2.3: The Role of the Mentor vis-à-vis the Student Teacher (Rice, 2008)

Rice notes that this model points to trainees learning to teach in school with mentors acting as assessors within a competency based model. She goes on to question how much contribution to theory is made by the mentors. Underpinning this model is the point that, whilst trainee teachers learn to teach in schools, the mentors are not trained to be mentors by the partner HEI. Rather they are made familiar with the partnership requirements for mentors.

Furlong and Maynard's (1995) alternative model describes five typical stages of development for the trainee teachers to which mentors need to adapt and respond. These are early idealism, personal survival, dealing with difficulties, hitting a plateau and moving on.

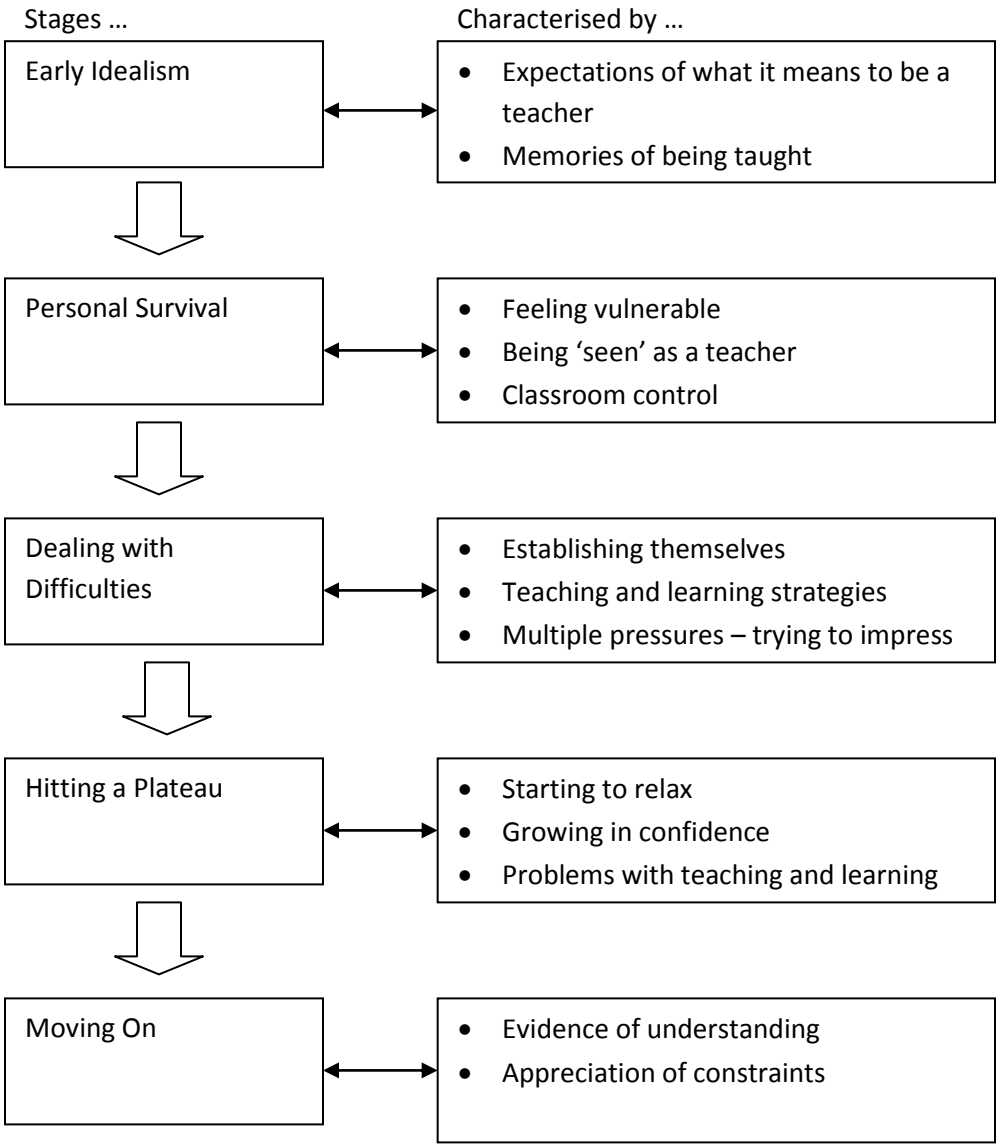

Figure 2:4 Staged Model of Trainee Teacher Development (Furlong and Maynard, 1995)

The stages described by Furlong and Maynard (1995) are influenced by personal factors, the impact of the PGCE programme and contextual factors (e.g. the nature of the school, the influence of the mentor). These stages are not seen as "discrete or fixed; rather they inter-related and mutable" (p73). They represent the way trainee teachers begin to control their own teaching. They have developed a model of mentoring to support these stages.

What this model highlights is:

1. the importance of the mentor being able to identify the progress of the trainee;
2. the need to get the balance right between support and challenge at each stage of the trainee's development.

While Rice (2008) focuses upon the role of the mentor in the training process, Furlong and Maynard (1995) consider the process from the perspective of the trainee teacher.

Edwards et al., (2002) note that the process within schools for trainee teachers involves mediation of curricular intentions and learning outcomes often by detailed lesson plans and the modelling of good practice. Yet it appears that mentors are not assisting trainees to acquire an understanding of teaching, but focus on polishing the visible performance of trainee teachers (Edwards and Protheroe, 2003). Additionally, there is literature indicating that mentors bring their own orientations and conceptualisations to the role (Abell et al., 1995, Saunders et al., 1995). Cain (2009) points to mentors appearing to either offer practical advice or to encourage reflection. He goes on to indicate that there is evidence that mentors rarely relate practice to theory either because their knowledge has become internalised and thus tacit, or because they are unaware of current theory. However, Rice (2008) also reports a number of studies pointing to mentors exhibiting a lack of understanding of learning theories; and suggests that this might explain the reason behind why mentors contribute little to the theoretical development of trainees. In another study, mentors expressed their regret that they were ignorant of current educational theory. They felt both (1) that theory was needed to underpin what they were saying about practice and (2) that the partner university should do more to provide them with access to it (Jones et al., 1997). Thus Elliott (1995) argues that the learning of student teachers from their mentors and the process by which this occurs is both unpredictable and idiosyncratic.

Another aspect of learning that might be supported through the type of sessions I have described here is the development in trainees of a language with which to talk about teaching and learning. As Bishop and Denley (2007) have pointed out, the early stages of a trainee's career are marked by an introduction into the language of pedagogy. They continue by noting that the acquisition and use of the language of professional discourse is

a “characteristic of apprenticeship in joining the community”. Quality conversations play a defining role in teacher learning since opportunities for dialogue enable learners to find meanings (Alsop et al., 2005b).

2.3 The Potential Offered By Video Technology

There are a growing number of studies describing how video technology can be used to support the professional learning and development of teachers at various stages of their career. Most of those referred to below describe the asynchronous use of recorded material. Three (McDevitt, 1996, Coyle, 2004 and Dyke et al., 2008) describe synchronous use at remote locations. Both frameworks offer some insight into the potential for the INSTEP project.

There are unique affordances offered by video technology. Both live synchronous and recorded asynchronous observation offer illustrations of complex classroom dynamics that are hard to describe in other ways (Borko et al., 2008, Santagata, 2009, Rosean et al., 2010). The locating of microphones in the classroom makes it possible to access small-group conversations and interactions that are not usually available to an observer in the room. Video technology facilitates (1) learning about effective classroom practice (Hatch and Grossman, 2009), (2) reflection on the craft of the classroom (Rosaen et al., 2008) and (3) understanding pupils’ thinking. This occurs by either observing recordings of their own teaching (Borko et al., 2008, Sherin and van Es, 2009) or by observing the teaching of others (Bliss and Reynolds, 2004). Video technology affords data that is both rich and multi-layered (Haw and Hadfield, 2011). It is rich in that it contains both verbal and non-verbal interactions and multi-layered as offers consideration about a range of different of foci.

Synchronous use affords reflection as classroom events unfold and can lead to immediate reflexive discussion. It supports live group observation of a lesson that is not otherwise possible. Asynchronous use offers the opportunity of teachers recording and reviewing their own practice. A video record can highlight “aspects of classroom life that a teacher might not notice in the midst of carrying out a lesson” (Borko et al. 2008, p418). Lasting records

of practice can be produced that can be replayed thus supporting deeper analysis. Additionally a series of episodes can be compiled that illustrate specific theoretical principles.

These affordances offer a number of features that support initial teacher education (Gardner and McNally, 1995, Brophy, 2007). Spiro et al., (2007) point to video technology affording the opportunity to promote deep learning in complex contexts such as classrooms. Video materials can also 'exemplify and share so-called good practice' (Newton & Sorensen, 2010, p2).

> "The contextualisation of the video makes it possible to present a problem with a level of complexity that is hard to match with a word problem. The video makes the complex problem tractable by using a vignette that is easy to grasp and engages students' everyday knowledge" (Schwartz & Hartman, 2007, p340)

Although describing interactions with video recordings, their findings point to a real potential gain from using live interactive video technology through INSTEP. Some of the features identified by both Gardner and McNally and Brophy include:

1. the ability to illustrate complex social interactions and events as they unfold, e.g. the activities occurring in a class being taught in a school laboratory;
2. the opportunity for tutors and fellow-trainees to raise questions or problems from what is being discussed. This includes tutor directed teaching as well as peer discussion and reflection, and so calls for the scaffolding of discussions;
3. illustration of the relationships between teacher and pupils and teacher and other teachers;
4. observation of a range of different strategies for dealing with diverse classroom situations. Observations can be understood as 'texts' and so be deconstructed;
5. opportunities for reflection through analysis of observed situations, evaluation of the strategies used and the stimulation brought about by discussing the issues observed;
6. good practice being observed by the trainee teachers that illustrate basic principles

While Gardner and McNally (1995) agree that there is no substitute for 'direct' interpersonal experience in teacher education, they also note that there is no argument

against using such technologies to make trainees aware of the kinds of situations that might arise. The work of Sherin and van Es (2009) adds a qualifying perspective. They note that discussion of what is observed is shaped by a variety of factors, including the relationship of the trainee teachers with each other, the role of the facilitator and the context of the lesson being observed. Such factors need to be accounted for in planning for the effective use of these technologies.

2.3.1 Using Interactive Video Technology to Support Teacher Learning

Zhang et al., (2011) indicate that a challenge for learning using video technology is that of promoting productive analysis and discussion. Brophy (2004) suggests a reason why video technology is powerful is that it reveals some of the complexities of teaching in ways that are comparable with those experienced by in-class observation. It offers the potential for beginning teachers to access the pedagogical content knowledge of experienced teachers. Observed classroom practice mediated by expert focus and commentary by the university tutor can provide insights and theoretical explanations for what is seen.

The effects on teacher learning are discussed by Seidel et al., (2011). They write about:

1. The effect being an activating experience – observation of authentic classroom experience, even though it is a second-hand experience, can leave the observer feeling 'inside the event'. This is highly motivational and the observers are able to make multiple connections with their own experience – a process they describe as resonance.

2. Professional vision – drawing from the work of Sherin and van Es (2009), Seidel et al., (2011) discuss noticing and knowledge based reasoning. Through noticing there is the identification of what is relevant from many things that occur simultaneously in a classroom. Noticing can then lead to reasoning (based upon professional knowledge) thus observed classroom activities are located in a theoretical framework.

A critical question concerns what it is that teachers (of all experience) are expected to learn from such interactions. Sherin and van Es (2009) suggest that there are three areas (which can overlap) to be considered:

1. Support the learning of new pedagogical techniques. The focus here is to observe the exemplary practice of others;
2. Enhance subject knowledge;
3. Develop awareness of classroom interactions so that the trainee teacher moves from paying attention to surface-level features to being able to discern more substantive interactions.

It is in this context that Sherin and van Es (2009) raise the question of what is being observed. They offer two considerations. The first is to illustrate exemplary practice to provide a vision of what can be possible. The second is to illustrate teaching dilemmas which offer trainees the opportunity to reflect upon the problems of teaching. Whatever is chosen, it should be planned to provide opportunities for discussion, evaluation and reflection.

2.3.2 Observation

There has also been an increase in the use of video material for teacher training purposes in the United Kingdom. Much of this has come out of the National Strategies in English, Mathematics and Science. However, a major criticism of such material is that it is often presented as being staged and therefore lacking in reality. Towers (2007) notes that beginning teachers are often intimidated by "carefully selected extracts featuring experienced teachers and apparently highly motivated and responsive pupils" (p2). As Brophy (2004) suggests, beneficial videos show those teachers with whom the trainee can identify. Authentic classroom practice is important (Bliss and Reynolds, 2004) as such videos resonate with trainee teachers in that they illustrate 'real' teachers with 'real' pupils (Newton & Sorensen, 2010).

An important aspect of developing professional expertise is the ability to both notice and interpret classroom events (van Es & Sherin, 2010). Rosaen et al., (2008) comment that

explicit noticing is critical for change and development of practice. Thus van Es & Sherin (2010) indicate that teachers need to:

1. Learn to pay attention to what is important;
2. Make connections between classroom interactions and the principles of teaching and learning;
3. Interpret given situations.

Several authors write about the particular value of classroom observation as a potential pivot between theory and practice. This is a complex process hence both Brophy (2004) and Newton & Sorensen (2010) emphasise the importance of focussed task / activity design for observing teaching sessions. The observation should have clear pedagogical purposes. It needs to be effectively planned in order to support the trainee teachers in their noticing of key events and so facilitate reflection through collaborative discussion. Without it observation can be passive.

Perception is a crucial factor in professional learning particularly at the beginning stages of a career (Korthagen, 2007); and Robinson (1998) describes the major function of educational theory as supporting the way that practice is perceived, rather than seeking to elicit solutions to practical problems. However, video technology can highlight and capture the complexity of classroom interactions and provide opportunity for teachers to reflect on those interactions (van Es & Sherin, 2010).

The Video Analysis Support Tool used by Sherin and Han (2004) at Northwestern University is a software environment allowing users to edit or manipulate digital video. This was used with six secondary trainees from Science and Mathematics. They found that these trainee teachers moved from simple chronological descriptions to more specific detail in the interactions they observed, i.e. they progressed from basic to more detailed analysis. In another study, Towers (2007) reported that trainees had the opportunity of investigating a particular episode when observing a recorded excerpt of a lesson. The challenge is one of developing within trainee teachers an ability to analyse practice.

The Diver Project from Stanford University aims to use interactive digital video to provide reflective commentaries and to offer what is described as ‘guided noticing’ (Pea et al.,

2006). Although different from INSTEP technology, the Diver Project uses single screen viewing with supported written comment to present opportunities for beginning teachers to grasp, recognise and discuss specific events within a classroom. This is being used to develop the practice of teachers in planning, assessment and reflection. It is, however, important to consider what is being observed. Sherin et al (2009) suggest two areas for consideration. The first is for illustrating exemplary practice and thus providing a vision of what could be possible. The second is the illustration of teaching dilemmas so as to provide opportunities for reflection on the problems of teaching.

2.3.3 Remote lesson observation

Successful online observation is a demanding process (Dyke et al., 2006). It requires the observer to both manage the technology as well as make comments and judgements about what is being observed. Dyke et al., (2006) indicate the importance of being able to switch views from teacher to learner in order to check and confirm their observations. They comment that in the class the observer makes judgements about what is seen by also glancing around the room and, for example, registering the level of engagement of the learners. However, the presence of an observer in the classroom may well alter the dynamic of the class. McDevitt (1996) draws attention to the possible effect on the teacher. She reports that when undertaking observation of experienced colleagues, trainee teachers reported only seeing low level teaching activities and low level questioning. However, when the observation was via a remote link the teachers were seen to use a wide range of activities and use higher order questions.

One advantage of the INSTEP project is the use of multiple cameras and the potential for split screen observation whereas the Southampton project, led by Dyke, used video-conferencing protocols and required much more manipulation of a single camera. However, Harford & MacRuaire (2008) raise a note of caution. Real-time observation does not allow for student teachers to observe their own practice, nor does it allow for replay and the subsequent detailed deconstruction of the practice of others. A key question concerns the

relative merits of trainee teachers observing their own lessons compared to observing that of someone else even if that person is very experienced.

2.3.4 Reflection and Analysis

Borko et al., (2008) argue that the contexts and activities in which individuals learn are fundamental to what they learn. Classrooms are powerful contexts; but this does not imply that all professional learning for teachers should occur in the classroom, because another alternative is to bring what they call 'tangible artefacts' (p418) into the training setting. Such artefacts include lesson plans, pupils' work and videos of their lessons, All these can generate classroom and student focused discussions outside the classroom itself.

The impact of video as a tool for enhancing student teachers' reflective and analytical ability is widely reported (Copeland and Decker, 1996, Whitehead and Fitzgerald, 2007, Hopkins, 2001, Rich and Hannafin, 2009). Harford and MacRuaire's (2008) study of the use of peer-videoing amongst student teachers found that this process enhanced the development of reflective skills which in turn had an impact on classroom practice. They theorised that the peer-based component was critical in scaffolding the reflective process. This has importance for those INSTEP equipped schools that take two trainees in that the potential for INSTEP to enhance classroom practice is thereby increased.

The peer-based component in supporting the reflective process also occurs when groups of teachers experience collaborative learning (Barnett, 2006). Video-taped classroom experiences can provide teachers with a common framework for discussion as they watch and reflect on the same pictures. They are afforded opportunities to articulate and reflect upon a shared classroom experience. Such technologies enable trainee teachers to view many different teaching experiences. Kong et al., (2009) consider recordings to be valuable by affording trainee teachers with potential information for evaluation and analysis of their classroom performance. The case for recording is also implicit in Rosaen et al's (2010) observation that studying video excerpts can move trainee teachers' reflections from vague impressions on first sight to a more critical analysis of classroom interactions. To date,

evidence suggests that the use of video technologies can augment and extend teacher reflection by facilitating and structuring the analysis process (Rich and Hannafin, 2009).

A Japanese study reports the use of video-based reflection to enhance the mentoring process for trainee teachers (Asada and Uosaki, 2006). Their premise was that, if the mentees could identify their areas of difficulty, they would voluntarily seek guidance from their mentor or other colleagues. Such difficulties were identified by the trainee from the video and subsequently jointly reflected on with the mentor, thus using the mentor's experience and expertise. They found that the trainee teachers began to engage in a reflective teaching cycle through which the trainee's understanding of the teaching problem changed. Roth (2007) reports that by viewing recorded practice the teacher is able to retrospectively study and reflect on that practice away from the emotional involvement that occurs during and immediately after a lesson. However, Rich and Hannafin (2009) also found that collaborative reflection between trainee and mentor was critical to developing reflection on practice. This may be a consequence of trainee teachers theorising rather than reflecting (Hagger et al. 2008).

Borko et al., (2008) argue that a video recording of a lesson can support collaborative learning focussed on reflection, analysis and consideration of alternative pedagogical practices. Mentors can select excerpts so that particular features of teaching and learning can be addressed. The mentor can 'freeze' the evidence at critical moments and discuss what had or had not been done in the midst of the moment (Whitehead and Fitzgerald, 2007), the result being that trainees see 'deeper'. One consequence of this is that the role of the mentor changes. Rather than being an expert, the mentor reflects with the trainee about aspects of professional knowledge and practice.

An important issue for the mentor is to use the output from video technologies to scaffold and support teacher reflection (Rich and Hannafin, 2009). The Video Analysis Support Tool (VAST) reported by Sherrin and Han (2004) scaffolds analysis through guided noticing where the teacher focus was to analyse pedagogy. This developed from, 'what do you notice' to 'provide evidence and interpret what you see' to posing questions about the observed lesson.

While it is common for trainee teachers to observe and subsequently question their mentor, Whitehead (2003) describes the impact of the mentor's own lesson being recorded. The impact of joint critique and analysis helped to develop trust, standardise judgements and break down some of the barriers to do with status.

Hopkins (2001) reported the impact of using video recording to analyse data of teacher-pupil interactions in an 11-18 comprehensive school. The process involved teachers observing video recordings of their own practice with a trusted colleague; identification of areas for development; implementation and subsequent analysis of further video footage. Her findings, though limited to a case study of an individual school and CPD in contrast to initial training, point towards potential benefits from using the INSTEP technology with trainee teachers. Hopkins' data indicated that initially the focus was behaviour and classroom management, mannerisms and the length of time pupils and teachers spoke. This subsequently changed to how the pupils conducted themselves in lessons (how did they work in groups; how did they articulate their thinking) and further to ways the teachers might intervene for the benefit of pupil learning. She describes a trajectory of reflective learning. A similar effect was identified in the use of the Video Analysis Support Tool (Sherin and van Es, 2006). Initial focus was on what they describe as teacher-centric actions. This subsequently developed into examining pupil thinking. The technology facilitated teacher reflection on how their practices influenced pupil learning.

What Hopkins describes is a process, best supported by a colleague, where teachers were able to identify areas for their own development and implement the necessary changes. Where appropriate the process was extended to coaching for a particular skill or strategy.

2.3.5 Mentors becoming Coaches

Coaching using analysis from video feedback sessions is regularly used in professional sport. It has been shown to increase both knowledge and understanding (Groom and Cushion, 2005) and motor skill acquisition (Liebermann et al., 2002). Coaches show players a certain passage of play in order to highlight the points they are making (Kent, 2003). Liebermann et al., (2002) note that the use of this technology augments and improves the feedback athletes receive during training and competition.

Synchronous coaching (Hooreman et al., 2008) has the potential to be developed using the INSTEP technology in order to enhance the pedagogical development of beginning science teachers. The configuration of the tie microphone enabled both an audio feed for transmission but also included an earpiece which allows for what Hooreman et al., (2008) call 'whispering in the ear'. They report that having immediate feedback during the lesson followed by a review of the recording was preferable to delayed feedback as it was remembered better. The difference between this and radio-assisted practice (Allen, 2007, Tomlinson and Swift, 1992) is the linking of the comments given in the lesson to a review of the video recording; thus the trainee teacher gets to see what the mentor / coach was observing at the time.

Historically, the nature of coaching teachers has been asynchronous, i.e. a reflective discussion with mentor / coach in a follow-up after a lesson has been taught. The advantage of this is that the trainee teacher has opportunity to reflect on and subsequently learn from his / her mistakes (Hooreman et al., 2008). Hooreman et al., (2008) describe a study where discussion was undertaken of video fragments of a lesson in which the trainee teacher was guided during the lesson by a radio link from the mentor. This is described as synchronous coaching. It appeared from this study that synchronous coaching had significantly greater effects than the asynchronous coaching on the quality of the pedagogical development of the trainee teacher. What they report is that this guidance not only supported trainee teachers in difficult moments in the classroom but also helped the trainee remember episodes better. What they do not discuss is whether this promotes deeper reflection and understanding.

2.3.6 Other Issues

There are a number of additional issues raised in literature regarding the use of video technology as an educational tool which require consideration:

1. The relative merits of live synchronous observation compared to recorded and asynchronous observation;
2. The time span of the observed lesson;
3. The size of the participating group;

4. The willingness of participants.

Coyle (2004) and Dyke et al. (2008) report that live synchronous use supports reflection and evaluation of classroom activity while it happens. This compares with asynchronous use, for which there is more literature, involving the recording of classroom activity for later reflection and evaluation. Santagata (2009), however, makes a strong case for video recordings and asynchronous discussion. She argues that this allows for in-depth analysis of classroom activity; analyses that would not be possible during a live lesson. As Rosaen et al., (2008) state, "it affords the luxury of time" (p349). The value of recordings leading to asynchronous review is in affording opportunities for post-lesson reflection (Sherin & van Es, 2009). They are actual records of lessons rather than perceptions that may alter over time (Kong et al., 2009). It supports the trainee teacher by providing a framework to externalise their thoughts, i.e. when supported by appropriate guidance it can lead to reflection on action. A comparison of the benefits of synchronous and asynchronous use is shown in table 2.2.

	Advantages	Disadvantages
Synchronous Use	• supports reflection of the classroom activity as it happens • live observation can lead to immediate and reflexive discussion	• analysis is weaker • issues / incidents can be missed • doesn't allow for trainee teachers observing their own lessons
Asynchronous Use	• allows for later (and repeated) reflection • permits in-depth analysis that may not be possible in a live lesson • it is possible to embed instructional material into the video at the point of delivery	• the observer's gaze is fixed with no opportunity for looking around the classroom particularly if multiple cameras are being used • changes the nature of the event and how it is viewed

Table 2.2 Synchronous vs. Asynchronous use developed from Dyke et al. (2008) and Santagata (2009)

The time given to observing teaching is subject to debate. Brophy (2004) makes the point that long periods of observation of a specific lesson can result in redundant segments, i.e.

there will be observation of portions of lessons that are irrelevant to the planned outcomes of the session. Miller and Zhou (2007), however, indicate that a problem with short segments is impressionistic as opposed to reflective consideration of what has been seen. Brophy (2004) also writes that teacher educators looking to promote learning just from critical incidents tend to use brief clips whereas those wanting to add the dimension of a group development of professional growth tend to use longer clips.

The size of the participating group is not well developed in literature. Describing ICE[15], Newton & Sorensen (2010) suggest that 6-10 people being the optimum group size to have active engagement. None of the other projects give guidance as to optimum group size.

Dyke et al (2006) reported a small group of teachers in further education colleges who would not agree to online observation, citing concerns such as confidentiality, the intrusiveness of the equipment in the classroom, the inability to capture online the live ethos and atmosphere of a class and just being uncomfortable with being seen on camera. Video technology can produce feelings of being exposed to risk.

2.3.7 Video Technology and Professional Learning

Brophy (2004), summarising some theoretical aspects of using video technology, identifies a number of regularly occuring perspectives:

1. there is an emphasis on the situated learning of theory when using video technology;
2. there is a recognition that knowledge is co-constructed in a learning community often mediated by an 'expert' tutor.

Common theorists cited include Schön (in developing reflective practice), Shulman (in understanding pedagogical content knowledge) and Lave and Wenger (for communities of practice)

Sherin et al. (2009) draw upon a 'situative view of learning' (p214) emphasising the social dimension as individuals participate in what they call a video-club community. In a video

[15] ICE, the Interactive Classroom Explorer, is a computer-mediated interface for viewing and critiquing digital video.

club a group of teachers meet to watch and discuss excerpts of videos from each other's classrooms. Important influences upon the learning that occurs are the discourses, tools and artefacts used by that community (Lave and Wenger, 1991). In the context of their research (and of importance to INSTEP) is the view that the interactive video is an an important artefact. They draw upon the work of Putnam and Borko (2000) who argue that a situative perspective highlights the need to ground teacher learning in the practices of teaching and to position the activity of viewing the lesson within a professional community.

Coyle (2004) also recognises the importance of community. However, she interprets the learning process as social constructivism based upon the work of Vygotsky and Bruner. This posits that the community plays a central role in assisting the trainee teacher to make meaning in developmental zones. Working alone, learners can only construct an individual and limited view of the world. However, by sharing ideas with both peers and knowledgeable others they will extend their understanding and knowledge construction. This provides for learning through communication and the need for environments that assist in the scaffolding and co-construction of meaning.

An important application of this is making tacit knowledge accessible. Eraut (2004c) argues that it is important to develop a discourse in order to reflect and discuss deeper conceptualisations of practice. He continues by writing that approaches to sharing tacit knowledge include the demonstration of skills, discussing commonly experienced episodes, describing incidents and reviewing recordings of episodes.

Thus literature points to professional learning being best supported by video technology when:

1. observation is planned with specific learning outcomes in mind, i.e. it is highly relevant;
2. there is both noticing and interpretation of classroom events. This also includes preparation for viewing;
3. the facility of reflective practice is afforded;

4. there is a framework for social constructivism. Learners' use of the output needs to be scaffolded;
5. there are 'dialogic and communicative approaches to learning' (Newton & Sorensen, 2010, p3) often mediated by an experienced tutor. Brophy (2004) speaks of the "value of discourse for supporting learning" (p303) and so frequent formats for use involve "an instructor who would show the videos in the group setting and engage group members in discussion and follow-up activities" (p303).

2.4 Management of Change

The leadership of the INSTEP project needed to manage a complex technological innovation, because:

1. The technology was evolving throughout the project;
2. The project was set across different institutions: the university and six ITE partner schools.

Although the leadership of the INSTEP project does not form the major thrust of this thesis, the way in which this innovation was managed was bound to affect its impact and its overall success. Innovation may be thought of as any activity or practice that involves people in changing established routines (Somekh, 1996). But, for innovations to be successful, these changes have to be developed and owned by the practitioners' understanding and subsequent professional action (Fullan, 1991).

Table 2.3 below summarises a range of criteria for determining the potential success or failure of innovative projects. These criteria, compiled from Whittaker (1999), Belassi and Tukel (1996) & Wateridge (1995), treat change as a political and administrative process that involves decision-making and persuasion.

Criteria for Potential Success of Innovations	Criteria for Potential Failure of Innovations
• Project achieves its purpose • It satisfies the needs of the owners, users and stakeholders • It meets its pre-stated objectives • It is produced to specification, within budget and on time • It satisfies the needs of the project team	• Poorly defined objectives • Objectives changing during the project • Poor project planning • Wrong choice of project manager • Improper basic managerial principles • Lack of communication and goals • Failure to act as a team • Turnover of key individuals associated with the project

Table 2.3: Criteria for the potential success or failure of innovations

Everard and Morris (1985) and Lueddeke (1999) describe practical frameworks for guiding change and innovation, which include issues such as the need for change, planning and implementing the transition and evaluating the process. They also consider deeper strategic issues such as the integration of theory, practice and evidence, the extent of collegiate decision making, the capacity for existing practices to be amended and the credibility of both the change process and its promised outcomes. Hastings (1995) argues that projects become most complex when they work across different organisations, different cultures and different locations.

Fullan (1988) identified a number of characteristics that are critical to the implementation of such an innovation:

1. Identifying the need for change – the provision of a clear practical picture of the discrepancy between current practice and that which should arise as a consequence of the innovation;
2. Giving clarity to the complexity of the change – Everard and Morris (1985) describe the implementation of an innovation as a multi-dimensional change that impacts upon relationships, unwritten norms and vested interests. Hence they are likely to fail when project leaders assume that everyone else will see the logic of their

proposal. Implementing change requires both detailed development and mutual agreement.

3. The quality, availability and flexibility of the resources – are they sufficiently well-developed to support the proposed changes?

Fullan (1991) argues that most change efforts are focussed on regulations and materials but overlook people, especially their behaviour, beliefs and skills. He goes on to argue that people are necessary for success. Thus, real changes occur when perceptions alter and individuals develop the capacity to either implement them or reject them (Scott and Robinson, 1996). Otherwise the project will be managed as a technical system rather than a behavioural system.

Eraut (2004b) argues that change is often treated as a political and administrative process rather than a learning process. While the problems of managing change are often discussed, the matter of learning how best to promote and facilitate change is less well discussed. Pedler et al (1991) also wrote about collective and individual learning being important to the way individual and collective practices are transformed, and managers learn how best to promote and facilitate change.

Argyris and Schön (1974) raise yet another complication: the values practitioners espouse in a public setting may differ from those embedded in practice. People have mental maps which affect the way they plan, implement and review their actions. It is these mental maps, they argue, that guide an individual's actions rather than any theories they explicitly espouse. Thus Argyris and Schön write of theories-in-use (that which governs behaviour and tends to be tacit in character) and espoused theory (the words we use to convey what we do). Theory-in-use is implicit in performance and constructed from observation, whereas espoused theory is that theory used to explain or justify actions (Argyris and Schon, 1996). Elements of theory-in-use include governing variables (e.g. policies, custom and practice, bias and assumptions), action strategies and the management of consequences. Effectiveness is related to the degree of congruence between theory-in-use and espoused theory.

Practitioner discourse is important in bringing about change and implementing an innovation. This covers practice, the allocation of tasks and responsibilities, and discussion with clients and stakeholders (Eraut, 2004c). Such exchanges of knowledge and information are also influenced by inter-personal relationships. The quality of discourse is affected by the time it takes to establish relationships of trust, and it is also affected by changes in the membership of working groups. Two other factors regarding practitioner discourse are the role of *tacit knowledge* which limits what people are able to say, and the role of *deceptive discourse* which controls what people choose to say, i.e. being self-protective when one's own practices are under discussion.

Eraut (2004b) argues that new practices cannot just be learned, they have to be recreated for the new contexts in which they will be needed. The implications for learning are that practitioners need to be:

1. Made aware of the implications and challenges involved in adopting the new practices;
2. Given a great deal of support, especially in the early stages where there is the possibility of disorientation and disillusionment;
3. Encouraged to share their experiences.

In INSTEP this practice should involve training in the use of the new technology, participation in problem-solving activities regarding the effective application of the technology, talking aloud about what one is doing and learning from other practitioners.

Scott and Robinson (1996) note that effective innovation needs to "generate pedagogical and people orientated strategies" (p134), a point supported by Fullan (1991) who argues that, if educational innovation is to be successful, there need to be changes in teaching resources, teaching strategies and beliefs.

When describing the Initial Teacher Education and New Technology Project (INTENT), Somekh (1996) noted three key features found in successful theories of innovation:

a) an emphasis on deciding foci and strategies within each participating institution, rather than having them centrally determined;
b) providing external support which includes planning time and meetings of the inter-institution project team;
c) regular site visits.

What Somekh (1996) described was a partnership between institutions working with technological changes in education, which led to programme planning that built upon the strengths and expertise of colleagues within each partner institution.

More recent concerns about technology innovations are well described by Koehler and Mishra (2008), cited in Borko et al, (2009), who warn that the process of continually learning to use the evolving technology can produce ambiguity and frustration:

a) A consequence of the instability of the new technologies caused by the rapid pace at which they are developed and disseminated is that the knowledge to use them is never fixed;
b) Innovations in technology are often distributed before they are fully tested and functional, leaving them error prone and riddled with bugs;
c) Institutions have limited resources for both maintaining and extending the infrastructure, and developing individuals' capacity to effectively use the technology.

The literature points to the potential that the INSTEP technology may have for enhancing the ITE experiences of trainee teachers, particularly in developing their knowledge and their professional learning. However, there is warning that the effective implementation of a complex innovation is not straightforward, and needs both effective partnership between the university and partner schools and collaborative learning in the use of the new and developing technology.

2.5 Literature Review and this Evaluation

My three research questions (p20) arose out of discussion of the literature with specific consideration being given to teacher knowledge, the mentoring role and the potential offered by video technology.

Hascher et al. (2004) indicate that becoming a good teacher requires both practice and professional learning that fosters a more detailed theoretical knowledge. This would apply to the professional formation of beginning teachers as well as the professional development of more experienced teachers. Thus the evaluation raises questions about how the INSTEP technology can be used illustrate complex classroom practice and so add to an individual's professional knowledge, support the mediated narrowing of the theory-practice divide and support the CPD of science teachers in partnership schools.

The literature also points to the important role that mentors play in trainee development. Mentors have an important role in the development of beginning teachers through supervision, training and assessment (Saunders et al. 1995). Gujral (2005) points out the complexity of the role as the trainee's needs change throughout the school placement. This raises an important issue for consideration in the evaluation namely how can the INSTEP technology can be used to support, enhance and even change the nature of the mentoring role.

Underpinning the professional development of beginning and experienced teachers and the mentor role in this context is the way the potential of the INSTEP technology is exploited. The affordance of video technology and how such technology is used in both synchronous and asynchronous contexts has been discussed. This evaluation will explore the extent to which the INSTEP technology contributed to teacher learning.

Chapter 3 – Methodology

The evaluation of the INSTEP project was undertaken during years 2 and 3 as a collaborative effort between the internal and external evaluators. The two teams worked together on design issues and instrument development. Data was shared in order to increase capacity, maximise opportunities for data generation and minimise duplication.

3.1 General Introduction

The external evaluation of the INSTEP project (Mitchell et al., 2007) made judgements about:

1. The benefits of the INSTEP project for the student teachers;
2. The benefits of the INSTEP project for the schools and, if possible, the benefits to pupils in terms of teaching and learning;
3. The benefits of the INSTEP project in promoting partnership between schools and the University.

These relate to the main objectives described in the "Key Messages" document. The external evaluation was influenced by the requirements of the sponsors, the charitable foundation, as well as being subject to the restrictions of timescale and cost.

No stated brief was given for the internal evaluation; and the university tutor team gave no guidance on the balance of the evaluation between accountability, development and knowledge[16]. However, I was able to identify a core issue that encompassed both participants and key stakeholders: "Where and how is INSTEP going to have the greatest impact?" This formed the basis of my research questions (see page 20).

[16] The impact of this is discussed in Sections 5:3 Missed Opportunities (p116-118) and Section 5:4 A Personal Insider Perspective (p 125-129)

However, as the project progressed it became clear that only my first research question could be addressed[17].

3.1.1 Context for the Research

A model of teacher education was developed by the university tutor team during a period when their teaching was temporarily based at a local partnership school. The university component of the science PGCE programme involved using teachers and other school resources where appropriate and the PGCE tutors, on occasion, provided cover to enable practitioners in the school to work with the trainees. This model ensured that trainees had access to appropriate examples of good teaching practice and classroom management as they occurred, while still retaining their usual full access to the expertise of the PGCE staff. The InSTEP project aimed to extend this model of teacher education to a larger learning community using an interactive video system between the University and six partner schools.

The initial framework for approaching the internal evaluation of the InSTEP project was predicated on an understanding, derived from the early planning meetings, that:

a. All the six partner schools were fully committed to the processes and practices of the InSTEP project;
b. Training would involve all mentors through the termly mentor meetings;
c. The technology and infra-structure would be quickly available to the partner schools.

3.2 How the INSTEP Technology was used

The key benefits anticipated from INSTEP were linked to the interactions that occurred during the university INSTEP teaching sessions (see section 1.1), where trainees were able to observe live lessons in a partner school. Central to this process was the live commentary and guided exposition from the tutor which both supplemented the observation being made and facilitated peer discussion with other trainees.

[17] This is described in more detail on pages 20-21

3.2.1 Remote observation of classroom activities by the trainee science teachers

This was the most common use of the INSTEP technology. 28 of the 29 trainee teachers surveyed at the end of the first full year (year 2 of the project), said that they had observed school lessons contemporaneously in university based sessions.

The university-based teaching sessions were reported (by the tutors and trainee teachers) to comprise a number of features:

1. A tutor-led theoretical perspective upon a specific aspect of teaching and learning that would be illustrated in the observed lesson. This happened either before or after the observation.
2. The live observation of whole or part lessons from a partner school. The technology afforded the facility of moving and zooming the cameras, tracking individuals as they moved around the room and observing multiple camera views of the same classroom.
3. Commentary upon specific features of the lesson, as it was proceeding, by one of the university tutors. This involved using the software to focus upon particular aspects of classroom activity. They were, for example, able to comment upon aspects of classroom practice that might otherwise be difficult to exemplify.
4. The trainees writing notes about what they observed.
5. Discussion amongst the trainees, facilitated by the tutor, about what had been observed. These were enhanced in that they were informed by common experiences. A group observation had occurred without disturbing the dynamics of the classroom.

On some occasions lesson plans were available from the school prior to the session. On rare occasions the class teacher was available after the lesson to answer questions posed by the trainee teachers.

The material available from live observation of remote classrooms, and the ability to process it, became more sophisticated as the project progressed. The technology was not

'tried and tested' at the beginning of the project when both audio and video feeds were fragile. Only two of the six schools were enabled to be on-line throughout this second year, and they were involved in continual testing of the technology. Whilst issues surrounding the video feed were quickly resolved, the facility for transmitting audio between sites (and particularly the type and positioning of microphones) continued to be problematic until well into year two.

3.2.2 Remote observation of trainee teachers

A less frequent use of the INSTEP technology was the remote observation of trainee science teachers. Only five of the trainees surveyed in year one reported being observed at the university whilst teaching in a partner school. On one occasion this was to demonstrate team-teaching and on others it was the formal observation that contributed to passing the school placement, one of which was a standardisation activity with the mentor observing (from an office within the school) simultaneously with a university tutor (observing from the university). This was an aspect welcomed by most school-based mentors as it allowed for relatively unobtrusive observation of their trainee teachers. The presence of the mentor in the classroom alters the dynamic within the class. One mentor illustrated the benefit:

> "The problem is that our presence in the classroom will always have an effect on how the students behave and one of the great things about having a system like this is to be able to take yourself out of the classroom but still to be able to view the kind of practice of the trainee teacher."

3.2.3 Other uses

Two other uses of the INSTEP technology were identified from the data. The first was contact between a trainee and the Head of Science of the first placement school before the beginning of the first placement.

The second was the post-16 showcase activities undertaken during the inter-placement period in both years of the project. These occurred in two formats:

1. One group (primarily those trainees with a Biology background in both years 2 and 3) undertook short presentations of A-level topics. These were delivered by the

trainees at the university and viewed by A-level students in one of the partner schools. There was subsequent two-way discussion.

2. The simultaneous carrying out of an A-level practical activity in Chemistry (year 2) and Physics (year 3). This involved the teacher in the partnership school teaching simultaneously both the school sixth formers (in the partnership school) and the trainee teachers (in the university teaching laboratory) through the INSTEP link. The trainees gained by working through the complexity involved in setting up and undertaking practical activities at A-level, whereas the sixth formers benefited by not being constrained to the shorter, more normal, teaching period.

The promised recording of trainee teachers' lessons in INSTEP equipped partner schools never happened.

3.3 Choice of Partner Schools

Although each of the six partner schools was identified as having particular expertise that could be shared within the partnership, the choice of the schools by the university being based on their working relationship with the tutor team. Each of them was personally approached and invited to participate. The mentors expected that three schools with a 'direct wireless line of sight' would be connected first (although one of these schools was found not to have this advantage) with the other schools being connected a little later.

3.4 Methodological Considerations

3.4.1 Using a Qualitative Approach

Given the small number of students and the limited number of school-based sites using the new technology, most of the evidence had to be qualitative. One argument for using qualitative methods is that through detailed interviewing and observation the researcher can get closer to the participants' perspective (Denzin and Lincoln, 1998). They go on to note

that in qualitative research there is the deployment of a range of methods[18] in the hope that a deeper understanding of the subject matter will be found.

Wellington (1996) describes the characteristics of qualitative research as follows:

	Qualitative
Aims	• To explore processes, relationships, meanings and subjectivities
Sampling	• Smaller sample selected from the population
Data Collection	• Researcher as the data-collection instrument
Analysis	• Emphasis on words • Generating theories and constructs • Findings are specific to their context
Rhythm	• Dynamic or cyclical – an iterative process that changes and develops

Table 3.1: Characteristics of qualitative research (drawn from Wellington, 1996)

He goes on to say that this is an interpretive approach, which is appropriate for studying processes, exploring perspectives and meanings, and developing insights into situations.

Clarke (1999) argues that evaluation is primarily concerned with determining the value of a policy or intervention; and this requires evidence of both the quality and the effectiveness of the project's approach. Denzin and Lincoln (1998) develop this further by suggesting that this type of research involves studying activities in their natural settings and attempting to make sense of the meanings people bring to them. The natural settings for InSTEP were the university teaching room and the classrooms in partner schools where InSTEP facilities had been installed. Given the small size of the internal evaluation, the collection of data was limited to tutors, mentors and trainee teachers; but I also had access to evidence gathered by the external evaluators and a significant amount of project documentation.

The more independent external evaluation was ready to challenge the internal evidence and conclusions; and the need for a formative perspective within the evaluation was emphasised by all those involved.

[18] Described on p81-82

The key features that define evaluation include:

- Answering specific, given questions
- Gathering information
- Facilitating reflection upon the impact of the project
- Suggesting improvements
- Making judgements
- Addressing the political situation in the schools and university

Evaluation is inherently a political enterprise (Cohen et al., 2000, Clarke, 1999). There are competing interest groups with divergent perspectives of the situation and conflicting needs. The evaluator has to make key decisions, e.g. which people will be served and what information will be most useful. The evaluation data will influence power relationships and thus impacts on the micro-politics of several local sites.

The political agendas related to performance, accountability, effectiveness and value for money, were an important remit for the external evaluators; while the internal evaluation took into account stakeholder interests and control, particularly the discussion and debate between university tutors and mentors. It also considered the pressure placed on all stakeholders to meet expectations with limited time and money. My own time was also an important consideration, especially when I was no longer an INSTEP participant.

Shaw (1996, p101) argues that the defining elements of evaluation are purpose and process. Its purpose is to provide information for stakeholders, both internal and external; and its process involves participatory evaluation with these stakeholders: reflecting on tacit knowing in practice; describing practice in a way that renders access to its strengths and weaknesses; and the feasible, mutual reflexivity of both practitioners and stakeholders.

The INSTEP project was subject to both formative and summative evaluation. Clarke (1999) discusses the distinction between them as seeking improvement through finding

the strengths and weaknesses of a programme or intervention, or seeking conclusions about the overall effectiveness of the programme. He contrasts these in Table 3.2 below.

	Formative Evaluation	Summative Evaluation
Target Audience	Programme managers / practitioners	Policy-makers Funders
Role of Evaluator	Interactive	Independent
Methodology	Mainly qualitative	Mainly quantitative
Frequency of Data Collection	Continuous monitoring	Limited
Reporting Procedures	Informal – via discussion groups and meetings	Formal reports
Frequency of Reporting	Throughout period of study	On completion of evaluation

Table 3.2: Formative and Summative Evaluation from Clarke (1999, p8)

Neither the internal nor external evaluations of the INSTEP project fitted neatly into this delineation. The target audience for the internal evaluation was primarily the curriculum tutors and mentors (i.e. programme managers and practitioners); my role was interactive and not independent, and the methodology was qualitative. In this sense there were a number of formative characteristics. However, data collection occurred periodically (more characteristic of summative evaluations) and the reporting (including frequency) occurred both formally and informally, throughout the study and after its completion.

3.4.2 Joint Evaluation

The co-working of internal and external evaluators also brings both benefits and disadvantages (Clarke, 1999). The internal evaluator offers insights into the organisational culture but can be over-influenced by the views of other insiders. External evaluators bring a more objective approach and expertise, but are primarily responsible to an external organisation. Several issues of this kind arose from our joint working:

1. Negotiating design issues and instrument development in a manner that supported both internal and external evaluations. It was important to maintain independence

yet also support each other, where possible, through the sharing of raw data. An action plan was devised, through meetings and regular correspondence, that enabled both evaluations to be conducted effectively;

2. Effectively using my initial position as a participant researcher through both

    - bringing insight and understanding to the external evaluation from my participant's understanding of the research setting
    - being supported by the external evaluators on those occasions when my participant role might have influenced the interview responses of my other colleagues

Clarke (1999), summarises the advantages and disadvantages of using internal or external evaluators below:

	Advantages	Disadvantages
Internal Evaluators	• Familiar with the history, background, policies, issues and culture of the organisation • Likely to be more committed to implementing evaluation recommendations, having been responsible for producing them • Likely to focus on the central concerns as perceived by management	• Have a vested interest in a particular outcome • Often over-influenced by the history and knowledge of organisational issues • Sometimes over-influenced by the known views of management • Unlikely to have had experience of a broad range of evaluation techniques • May be less committed to the need for evaluation • Be inclined to favour programmes developed in their own unit / section • Find it difficult to encourage stakeholders in their own organisation to actively participate in the evaluation process
External Evaluators	• An independent stance and offer a fresh perspective • An objective, critical approach • An overview of numerous organisations to serve as comparisons • A knowledge and experience of a wide range of evaluation techniques • A resilience to intimidation by management	• Ignorant of internal matters so that judgements may not reflect the complex reality of the situation • Unaware as to who are the key players in a particular setting and are thus more easily misled by interested parties • More interested in a report than in its implementations • Influenced by the need to secure future contracts • Insensitive to organisational norms and internal relationships • Primarily responsible to an external organisation

Table 3.3: Contrasting Internal and External Evaluation (Clarke 1999)

Both evaluation teams adopted what has been described by Anderson (1998) and Guba and Lincoln (1989) as a fourth generation evaluative approach. They describe first generation evaluation as being about measurement, second generation being descriptive and a third generation approach as considering standards and judgements. However, each of these fails to recognise competing values, interests and perceptions.

The emphasis of a fourth generation approach is to gain an in-depth understanding of all the effects (both planned and unplanned) of a programme. It is a constructivist evaluation based upon the issues, claims and concerns of the stakeholders. It has the potential to demonstrate the complexity of issues and facilitates both formative and summative feedback. This type of evaluation attempts to "make sense of, or interpret, phenomena in terms of the meanings people bring to them" (Denzin and Lincoln. 1998, p3). It is suggested by Loughlin and Broadbent (1996) that it also avoids the dominance of one individual / grouping. Nevertheless they acknowledge that issues of power are glossed over rather than resolved.

INSTEP was a complex project to evaluate (Mitchell et al., 2007). The partnership relationships between the University and individual schools varied in depth and there is a web of personal interactions between the university tutors, mentors and trainee teachers. Additionally the changes in school based mentors, and the changes in the INSTEP infrastructure as the technology developed, caused difficulties with continuity. Thus both the internal and external evaluations followed an iterative cycle of data generation, analysis and review. Iterative evaluation is effective in researching a developing project such as the INSTEP project where:

1. The interactions between people, organisations, and technology can be unpredictable;
2. The technology used was continually evolving, thus increasing the capability of the project;
3. Reactions to technologies are complex, and are influenced and shaped by a wide range of contingencies. Factors such as the quality of hardware and software, the nature of classes in schools, trainee teacher response, university tutor and teacher enthusiasm, familiarity with technology and tacit attitudes can all affect the educational impact of a project;

4. A turnover of mentors was affecting continuity.

Evaluating in such a context is contending with something of a moving target. Thus a responsive and flexible methodological approach was needed (Mitchell et al., 2010).

The evaluation corresponds to what Pawson and Tilley (1999) describe a realistic evaluation. Understanding the limitations that were being presented in terms of the development of the project and access to stakeholders both myself and the external evaluators adopted an approach that was pragmatic, flexible and iterative.

3.4.3 Practitioner Research

I was both the internal evaluator and a mentor in one of the INSTEP equipped schools in the project during 2004-2006 (years 1 and 2). This gave me an insider perspective which contributed to my understanding of what was really happening. It was, however, important to maintain enough distance to ensure that the analytical dimension of the insider / outsider approach worked effectively (Hockey, 1993).

Practitioner research (also described as insider research) is concerned with questions that are not always accessible through more traditional forms. Smyth and Holian (1999) argue that learning, insights and improved practice arise from immersion in the everyday working of a project. While Hockey (1993) writes that such researchers possess an intimate familiarity with the processes and issues involved that should be of great assistance in interpreting and exploring those processes and issues.

The potential advantages and difficulties are summarised below by Hockey (1993) and Wellington (1996):

Potential Advantages	Potential Difficulties
Prior knowledge and experience of the setting/context - insider knowledge	Preconceptions, prejudices
Improved insight into the situation and people involved	Not as 'open-minded' as an 'outsider' researcher
Easier access	Lack of time (if working inside the organisation) and distractions/constraints due to 'being known'
Better personal relationships e.g. with teachers and the tutor team. These were already established prior to the project	'Prophet in own country' difficulty when reporting or feeding back
Practitioner insight may help with the design, ethics and reporting of the research – this was particular useful with the external evaluators	Researcher's status within an organisation
Familiarity	Familiarity

Table 3.4: Issues Regarding Insider Research adapted from Wellington & Szczerbinski (2007, p24) and Hockey (1993, p5-8)

Hockey (1993) states that undertaking evaluative research in a 'familiar setting' has both benefits and pitfalls. The benefits include such matters as lack of cultural shock or disorientation, enhanced rapport with the participants and a degree of invisibility. Although I was regarded as less likely to alter the research settings, I was heavily involved as a participant who was endeavouring to shape the project by making my lessons available for remote observation, trialling aspects of the INSTEP technology, leading university teaching from a remote classroom and encouraging my trainees to be involved in out-of-class remote observation. I also brought to the insider researcher role access to both past and present histories, awareness of the nuances and idioms of the university and mentor groups and understanding the hierarchical position of their members. Being a participant includes participation in the narratives of that culture, and the participant researcher holds a privileged position (Le Gallais, 2003)

When considering the benefits and pitfalls of participant research, it is also important to consider the extent to which the researcher may also have multiple roles (Smyth and Holian, 1999, Coghlan, 2007). Labaree (2002) noted that an individual's profile, activities and research agenda all contribute to being an insider.

Preston-Shoot (2009) notes the difficulties of having role duality and multiple identities, which is considered by Gewirtz and Cribb (2008) from two perspectives:

1. Identity is not synonymous with but is related to role. Cheung (2008) suggests that identity involves the way we see ourselves and the roles we are expected to play. It determines the way we work;
2. Identity involves both personal perspectives and the way others see us.

Gewirtz and Cribb (2008) recognise that individuals both actively choose and negotiate their identities by strategically positioning themselves in relation to others, i.e. identity has meaning in relationships (Watson, 2006). This can result in having our identities constrained due to asymmetric power relationships and differential access. The importance, though, is the recognition of the link between professional identity and professional action (Watson, 2006).

The degree of being an insider is discussed by Labaree (2002) who points to the following factors that determine the degree to which an insider is positioned in the research:

1. The levels of access that are granted to the researcher;
2. The ability to understand and work within the groups' culture, political and power structures;
3. The ability to develop trustworthy rapports with the different participants.

The extent of access is identified by Brannick and Coghlan (2007) as an important challenge to the insider-researcher. They describe *primary access* as "the ability to get into an organisational system and be allowed to undertake research" (p67); and *secondary access* as "access to documentation, data, people and meetings" (p67). Insider researchers

have primary access but may have only partial secondary access when restrictions are placed on other parts of the organisation.

Darra (2008) identifies another challenge to insider-researchers, that of power relationships. She comments that "this could lead to participants denying or 'watering down' aspects of practice, especially when it may reflect badly on themselves or their colleagues. Alternatively they may 'talk themselves up' to present an ideal impression of themselves or their practice. In this way, one could argue that the researcher is being exploited instead" (p253).

The pitfalls of being a participant researcher are subtle. Hockey (1993) notes that the most frequent criticism is that the research context can be too familiar. This may be seen in a number of ways:

- The language is too familiar, so key terms can be overlooked
- The researcher takes tacit patterns for granted, so data analysis becomes superficial
- The participants can be uncomfortable in responding to questions if they may feel that the researcher already knows the answers.

The ability to undertake credible insider / participant research involves both an explicit awareness of the possible effects of perceived bias on data collection and analysis, and maintaining the anonymity and confidentiality of both participants and organisations (Smyth and Holian, 1999). In other words participant researchers need to build on the closeness they have with the setting, while at the same time creating an appropriate distance.

3.4.4 Ethical Considerations

My methodology was also guided by the ethical principles of the British Educational Research Association (BERA, 2004). This places the principle of informed consent at the centre of research activities (Burgess et al., 2006).

A complex innovation such as INSTEP requires a variety of ethical considerations. I have grouped these into 2 broad categories, my position as an internal evaluator and the issues surrounding the use of its technology being the responsibility of the university tutor team.

I was known by all the mentors, the university tutors and many of the trainee teachers in each year of the study. Hence my identity in the research required careful consideration. In years 1 and 2 I was both a participant (a mentor within a school) and a researcher. This meant that I had to professionally handle the asymmetric power relationships (Pickering, 2004) with my trainees, as well as formally discuss my social relationships with other stakeholders (Dunne et al., 2005).

I had been on the mentor-steering group for many years and had written part of the science handbook given to both mentors and trainees. This provided the range of challenges (both positive and negative) listed below:

Positive Challenge	Dilemma to be Overcome
Efficient communication with the stakeholders Knowledge of potential limitations and possibilities Ease of initial access – relationships were already established Shared understandings Opening up about deeply felt issues	What information is on or off the record? Information being provided in an "out of research" setting Protection of participants' anonymity and confidentiality, as many knew each other as well Ensuring that my assumptions did not affect previously shared understandings

Table 3.4: Issues of the Insider Researcher

My concern was to minimise the effect of any personal relationships during the interviews by encouraging participants to present their own understandings and reflections, rather than tell me what they thought I might want to hear. Having selected a semi-structured approach for the interviews with the mentors and the tutor team members, I needed to be very alert to these issues.

The briefings (adapted from Anderson, 1998) that I gave to the participants, both prior to the interviews and when completing questionnaires, were:

- An explanation of the purpose of the research and the procedures that would be used;
- A description of the benefits (including my use of the research for a professional doctorate) that might be reasonably expected, including incentives to participate;
- An offer to answer any questions concerning the procedures;
- A statement that participation was voluntary and that anonymity and confidentiality would be maintained throughout;
- A statement that the overall findings would be presented to a full mentor meeting.

The ethical partnership between the university and INSTEP equipped schools was implemented by the tutor team with the support of the mentors. Following initial exploratory conversations, confirming interest in the project, with each of the mentors from the InSTEP equipped schools, a letter was sent to each headteacher outlining the project and anticipated outcomes.

In the letter were statements that there would be no observation of lessons or other activities within the equipped classroom / laboratory without:

1. the prior consent of the mentor and trainee (if the trainee were to be the subject of the observation)
2. that any recordings of lessons became the property of the trainee / teacher being observed.
3. That written parental consent be obtained for the pupils in the class being observed/recorded.

Along with the letter was a generic letter to obtain parental consent for pupils to be observed, as well as a response form for the headteacher to sign that (1) s/he gave agreement for the school to be a part of the project and (2) s/he had established that any observations / recordings would not be used for performance management purposes. This also included those times when the technology was not being used for ITE but could be

used by the school for the professional development of teachers (although this latter possibility never occurred in any of the INSTEP equipped schools).

There were some tensions arising from having parental consent. My own experience of this was gaining 100% permissions for the three classes I anticipated being present during a live transmission. But this was not the case for other mentors in the other equipped schools, where alternative arrangements had to be made for certain pupils. However, I found it problematic when on several occasions I was contacted by tutors to show a live transmission without advance warning or shortly before a lesson. This was refused if any class members lacked permissions.

One major ethical issue occurred as the cameras were left permanently on with a continual live feed that could be picked up at any time at the university. This made schools vulnerable to non-agreed and unauthorised observations of teachers, trainee teachers and pupils without them being aware that it was happening[19]. The concerns around this issue were compounded by the mentors not being made aware that this was the case. Like the other mentors in the participating schools, I believed that transmission only occurred at the agreed times; so no robust discussion occurred. I was told this by one of the technical team long after the project had ended and consideration was being given to removing the equipment from schools.

3.5 Collection of Data

The external evaluators planned for a 'light touch' evaluation in years 1 and 2, with more detailed work being undertaken in year 3, before any internal evaluation had been decided[20]. This made it much easier for me to pursue my internal evaluation without significantly changing their plans. This was reviewed and confirmed in a joint meeting between the two evaluation teams in January 2006 (see pp. 125 & 126). The major stakeholders were identified as:

[19] There is a suggestion from two of the trainee teachers (pp. 95 & 107) that unauthorised 'dropping in to see what is happening' was a normal part of their experience. This meant that neither permissions of teachers / trainees nor parental consent for the pupils seen was obtained

[20] This is recorded in their January 2005 interim report

1. The trainee teachers;

2. The mentors;

3. The university tutors

Discussion took place as to whether any effect could be measured on pupils in the INSTEP equipped schools. It was agreed that this would be suitable for one of the trainee teachers placed in one of the INSTEP equipped schools to undertake as their Special Study[21] written assignment. The tutor team agreed to this suggestion but this was not taken up.

At the time of this meeting it was becoming clear that, even by the end of year 2, only 2 of the 6 schools would be connected. There were ongoing difficulties with the audio feed (a tie microphone gave a clear feed from the teacher but pupil conversations could not be heard) and it was unlikely that the issue of recording would now be addressed. The indications given in both steering group meetings were that these matters would be resolved in year 3.

Consequently it was agreed that, at the end of year 2, I would survey the trainee experience (appendix 2), and the external evaluators would re-interview those mentors who were interviewed just before the project went into schools. This reflected our ease of access to the participants and, in my case, enabled me to translate less formally collected evidence built up through the year in my role as a mentor into more formal responses. In year 3 semi-structured interviews were undertaken with the three main stakeholder groups to provide a more detailed understanding of the benefits of INSTEP on initial teacher education, and further developing the partnership with schools (particularly enhancing the mentor role) and CPD.

Outlines of the data collection and focus of the interviews are tabulated on pages 84 and 85.

3.5.1 Overview of Data Sources

This evaluation has drawn upon evidence from the following sources:

[21] The Special Study is one of the written assignments that contribute to the award of PGCE

a) Pre-INSTEP Interviews undertaken by the external evaluators with the school mentors who were expected to be project participants (page 88);
b) A questionnaire completed by the trainees from the 2005-06 cohort in the final week of their PGCE programme (page 91);
c) Transcripts of group interviews with trainee cluster groups from the 2006-07 cohort conducted by both myself and the external evaluators from with the transcripts being made available to each other without analysis (page 94);
d) Interviews with mentors from the 2006-07 cohort. I conducted these interviews alone and made the transcripts available without comment to the external evaluators (page 96);
e) An interview with the lead tutor (the transcript of which was made available to the external evaluators) and the transcript of the interview with another science tutor (this interview having been conducted by the external evaluators) (page 101);
f) Follow up interviews (April 2008) with two tutors and two former trainees were conducted after some initial analysis of the interview transcripts from the mentors and lead tutor in order to further explore how theory is matched with practice (page 105).

Additional evidence was gained from:

a) Agendas and agreed minutes of the INSTEP project steering group;
b) The annotated planning logs of the core team;
c) Audio diary logs of the lead tutor and field officer (these were only used in September of year 2)
d) Written communication from visitors to INSTEP activities;
e) Analysis of a DVD (February 2007) produced to illustrate how the INSTEP technology was being used to support initial teacher education

3.5.2 Data Collection

The research design evolved over the duration of the project and a summary of the data collection is shown below.

Time Frame	Internal Evaluator	External Evaluator
Year 1		Semi-structured interviews of mentors in the six potential schools
Year 2	Session evaluation of sixth form showcase activities Questionnaire for year 2 trainee cohort (29 replies from 32 trainees)	Semi-structured interviews of: • 2 participating mentors • Lead tutor and additional tutor
Year 3	Semi-structured interviews of: • 7 Mentors • Lead tutor • Additional university tutor • 1 cluster group of trainees	Semi-structured interviews of: • Additional university tutor • 2 cluster groups of trainees
Year 4[22]	Follow up semi-structured interviews with: • Lead tutor and additional tutor • 2 trainees from the year 2 cohort (then in their NQT year)	

Table 3.5: Outline of Data Collection

The questionnaire was piloted with four trainees prior to being amended and then used with the whole cohort. It comprised a mix of both *closed questions* to enable specific data to be gathered and *open questions* to offer the trainee teachers an opportunity to offer their individual perspectives (Campbell et al., 2004).

The three parts of the questionnaire were:

[22] The project came to an abrupt end in October 2007 (the beginning of year 4). The anticipated further funding, according to the Lead Tutor, had not materialised. Connectivity between the university and INSTEP equipped schools was terminated. The equipment remains (April 2010) unused and in position in the schools. Although the external evaluators had completed their work, I had hoped to gather further data through year 4.

1. A number of fixed response questions specifically related to their own background and their experience of the INSTEP technology in their training.
2. Some Likert rating scales (Cohen et al., 2000) with opportunity for additional open responses which probed the trainee teachers' individual perspectives on the impact of the INSTEP technology upon their own training.
3. Open questions to ascertain their suggestions as to how the INSTEP programme could have supported their PGCE training.

Semi-structured interviews were undertaken because of their flexibility (Gillham, 2005); and to obtain the most comprehensive perspective by aggregating as many viewpoints as possible (Pawson and Tilley, 1999). The same questions were asked of all those involved, and the interviewees were prompted by supplementary questions to ensure equivalent coverage. The questions were open, but probes were used when interviewers thought that there was more to be disclosed. The role of the interviewer was to remain neutral and to be non-judgemental by probing responses from all participants (Hagger et al., 2008). The semi-structured interviews focussed on:

Category of Interviewee	**Focus of the Interviews**
Trainee Teachers	• Their concerns regarding being involved in INSTEP • Their involvement in the INSTEP project • The benefits, limitations and changes brought about by the introduction of INSTEP upon themselves • *For those trainees in an INSTEP equipped school the following focus was added:* *The impact of INSTEP upon them in school*

Mentors	• Experience and mentor training • Their school's partnership relationship with the university • Perceived impact of the INSTEP programme used at the University upon trainees *For those mentors working in an INSTEP equipped school the following focus was added:* • *The benefits, limitations and changes brought about by the introduction of INSTEP upon them and their trainees*
University Tutors	• Their perception of the role of the partnership between the university and schools in ITE • Their use of the INSTEP technology in initial teacher education • The benefits, limitations and changes brought about by the introduction of INSTEP upon themselves • Perceived impact of the INSTEP programme upon trainees
Subsequent Interviews of the University Tutors and NQTs	• Further exploration of the use of INSTEP to integrate theory with practice

Table 3.6: Foci of Interviews

Following the completion of all this data generation, the internal and external evaluation teams exchanged their data by email. Data were subjected to a preliminary inductive analysis at each stage which identified themes emerging from a close study of the transcripts (Glaser and Strauss 1967). These themes were then developed through further detailed analysis of interview transcripts using Nvivo software.

3.6 Dissemination of Evaluation Findings

The findings of the evaluation were disseminated in a number of different ways in order to provide both formative support and a summative review of the project. As part of the

collaborative pattern of working, both the interim and final conclusions of both sets of evaluators were shared by telephone, email and on two occasions, a face to face meeting prior to being despatched to the project team and mentors.

I provided an update and formative feedback at each of the termly mentor steering group meetings throughout the period of the project. This was followed by a full mentor meeting where the same feedback was provided, and all mentors from the partner schools (whether INSTEP equipped or not) were invited to attend. The updates and formative feedback were not given to the trainee teachers and I am not aware of the mentors or university tutors sharing that information with them. The external evaluators provided written feedback to the university tutor team but this was not distributed any further.

Summative evaluation was provided in a number of ways. Following the conclusion of the project I gave a presentation of the major findings from the internal evaluation to the university tutor team and other representatives of the university ITE programme. Again the external evaluators provided written feedback to the university tutor team. Wider dissemination was undertaken through conference presentations (BERA 2008[23] and CAL 09[24]) with subsequent publications of papers based on these presentations (Mitchell et al, 2010 and Marsh et al, 2010).

[23] BERA 2008 – The British Educational Research Association Conference held in Edinburgh, September 2008
[24] CAL 09 – The Computers Assisted Learning Conference held in Brighton, April 2009

Chapter 4 – Findings

4.1 Pre-INSTEP Interviews (Year 1- July 2005)

Semi-structured interviews were conducted by the external evaluators with the three Heads of Science from schools, who were expected to be immediately involved in the INSTEP project in the following Autumn. Two of these Heads of Science were mentors on the university Science Initial Teacher Training programme. All three had links going back a number of years with the Science ITE tutor team and expressed their own personal desire to be involved in developing trainees and colleagues in their early years of teaching. One had been involved in joint work on Assessment for Learning, another on Curriculum Enrichment and the third was the host for two years while the university component of the PGCE science programme was school based due to re-development of laboratory services at the university.

There was a broad consensus amongst the three Heads of Science about their understanding of the project's aims. The project was seen as enhancing initial teacher training through enabling trainee teachers to see a variety of differing lessons in a range of contexts, to have modelled good practice recorded and available for discussion in mentor meetings and to have their own practice recorded and used as the basis of discussion in mentor meetings. Several comments illustrate this:

> "To be able to model some lessons and then play them back and say, 'look, I did this and I did that, and these were some of the key points to come out of that' is actually stronger than actually asking a trainee to observe in the first instance because they don't know what they're looking for."

> "When I do some observation of the trainee, it's a lot stronger to have the video in front of you and be able to say, I was observing this, now have a look at what you did. We can draw constructive feedback out of that."

There was a real sense that INSTEP technology could have a major impact in the way teachers are trained. Interactivity between mentor and trainee through live observation, and coaching through focussed discussion of recorded material from a trainee's lesson,

were perceived as the major benefits. The impact was thus of trainees seeing issues in classrooms before starting practice, directed observation of aspects of another teacher's lesson and developmental mentor meetings through the coaching of specific skills.

One particular perspective on how the INSTEP technology could affect the working with trainee teachers was expressed as follows:

> "We as mentors sit and observe their practice. The problem is that our presence in the classroom will always have an effect on how the students behave and one of the great things about having a system like this is to be able to take yourself out of the classroom but still to be able to view the practice of the trainee teacher."

This perspective points out that a mentor observing a trainee has an unavoidable impact upon classroom dynamics. Remote observation enables people to see a much more authentic view of issues such as behaviour management.

All three Heads of Science anticipated some impact on classroom behaviour in the first instance. The novelty effect of having cameras in the laboratory and having the teacher wear a radio microphone was seen by all three as being a distracter to learning. However, all three spoke of using similar strategies of explanation and practice runs before going live on a full session. It was anticipated that in a very short time pupils would become comfortable and familiar with the presence and use of this technology.

The biggest effect was perceived to be with trainees and departmental colleagues. Two Heads of Science indicated that they would make the technology an option for the trainees whereas the third was offering no choice indicating that this is 'how we do it'. However, using the technology with departmental colleagues for coaching and continuing professional development was seen as being at the discretion of the teacher concerned. The benefits of the INSTEP technology in enhancing working relationships with departmental colleagues were eagerly anticipated. One spoke of being able to record a series of lessons and then turning it into a training resource. Another spoke of being observed and recorded to model for others' peer observation, thus placing classroom observation away from performance management and putting it into the realm of learning from one another. The

third Head of Science spoke of this being a mechanism for teachers to talk about teaching and, in doing so, reflect on their own practice.

All three Heads of Science believed that having the INSTEP technology would probably enhance their relationship with colleagues in other schools. All were involved in leading other projects within their local authorities and were hopeful that INSTEP would support that. There was a culture of continuing professional development in each school.

There were also some concerns about the INSTEP project. Whilst each Head of Science expressed excitement with this development, it was tempered by caution. These concerns surrounded the ability of the technology to deliver what was anticipated, the ability to make this embedded practice for both trainees and departmental colleagues and the avoidance of using the technology for performance management purposes. As one said,

> "One of my concerns is that it does become embedded within our practice, it's not just a high-profile project and it happens once and then it dies off. I want it to be a continuous process. I want it to be of use to universities, I want us to really benefit from using it down here and I want to make sure that it becomes embedded in our practice here because it's a very expensive gimmick to have, if you're not going to use it effectively. To me that's about careful planning, about making sure we do use it effectively, not just for training teachers but within the school and making use of the equipment that we have got."

4.2 Evidence collected during the School Year 2005-2006 (Project Year 2)

During the academic year of 2005-06 only two of the INSTEP partner schools, including the one where I was Head of Science, had established sufficient connectivity to enable activities to be carried out. It was during the Autumn Term of 2005 that "live trials" were undertaken in the first two schools. However, at this point connectivity was only one-way; so a commentary by a curriculum tutor was needed to develop the issues arising in and from the lessons observed live in schools. Sound continued to be an issue throughout the whole of the evaluation period. Hearing the teacher in school or the tutor in university was achieved by Christmas 2005 with the teacher / tutor usually wearing a microphone and ear-piece for two-way communication. By the time the trainees had completed their first

placement and had returned to the university (February 2006) full two way links had been established, thus enabling trainees in the university to see and communicate with sixth form students in school, who could equally see and talk to the trainees. However, picking up the sound from within a class was much more difficult, and the issue of listening in to individual pupils or small groups continued to be a problem. All six schools had established links by September 2006.

4.2.1 Trainee Questionnaire of June 2006

This questionnaire (appendix 3) was completed by 29 of the 32 trainees (18 female and 11 male) in June 2006 at the end of the first full year of the INSTEP technology.

Section 1 of the questionnaire addressed the background of this cohort and is found in Appendix 2.

In section 2 the trainees were asked to rate themselves on two different scales:

(a) Rating each of their school placements on a scale of 1 (high) to 6 (low), and
(b) Grading themselves "in relation to your *current teaching expertise*" on a 4 point scale as *High, Good, Average or Below Average.*

18 of the 29 trainees (62%) rated both their first and second school placements as successful (1 or 2); and all of them graded themselves as being *good* in relation to their current teaching expertise. A further 5 trainees rated their first school placement as successful (1 or 2) but their second school placement less so (rated 3 to 5). One self- graded as *good*, and 4 graded themselves as *average* in relation to their current teaching expertise. One of those who rated the first placement as successful (1) viewed the second placement as unsuccessful (rated as a 5)[25].

5 of the remaining 6 trainees rated their first school placement as being less successful (all rated 3 to 6) than their second school placement (all rated at 2). All but one of these graded

[25] This trainee also recorded herself as being absent for 8 out of the 10 sessions when the INSTEP technology was used by the core team for training.

themselves as *good* in relation to their current teaching expertise, with the exception self-grading *as average*.

One trainee had two less than successful placements (rated 5 and 4) and self-graded as *average*.

Section 3 considered the trainees access to the INSTEP technology.

28 of the 29 observed lessons in 'real time' in schools via INSTEP; the 29th was the person who recorded herself absent from 8/10 INSTEP teaching sessions. Although 10 trainees recorded being able to speak to and question pupils in school via the INSTEP link, this only occurred on the occasion of the sixth form showcase in February.

Five trainees were observed teaching in their placement school through the INSTEP link at the university by fellow trainees, members of the core team and the external examiner.

Section 3 also asked the trainees to rate the effectiveness of using the INSTEP technology in supporting their training. The numbers of trainees rating in each category is also shown in appendix 3.

Section 4 invited the trainees to make open response statements to the question, "In what ways, if any, did you personally gain from having the INSTEP Project support the PGCE programme?" These responses have been summarised by sub-topic and placed in appendix 4.

4.2.2 My Role as a Mentor

During years 1 and 2 of the project I was one of the two participating mentors. I was an experienced mentor and had worked with trainee teachers for many years. Before starting the doctoral programme my focus was primarily on exposing my trainees to the best possible practice my colleagues could offer, to discuss and reflect on what they had observed and to support them through constructive feedback as they started to develop their own practice. The professional literature used was policy driven in terms of the National Curriculum and National Strategies, not by training from the university. I took the opportunity to challenge my mentees to critically evaluate their own thinking. However, the

theoretical framework I used came from 20 years earlier when I undertook an MA in Science Education at another university. Thus linking theory with practice was based on a dated theoretical framework. Although the taught component of the doctoral studies did not directly relate to the theoretical component needed to support trainee teachers, I began to re-read earlier material and to look for updated sources; and thus felt more able to support my mentees in relating practice with theory.

During the first two years of the project I undertook pre-agreed lessons which enabled the trainees at the university to observe assessment for learning, behaviour management and team teaching in action. Lesson plans for these sessions were sent to the university tutors prior to the observation. However, it was not unusual to receive a phone call immediately before a lesson requesting that I wear the tie-microphone, the implication being that the lesson would be observed. One of the trainees commented that some sessions at the university did not appear to be planned and sometimes they just dropped into a session. This was in breach of the agreement in the mentor steering group that all sessions would be planned in advance.

During the inter-placement period I led a joint session with my sixth form chemistry group (in school) and the trainees (in the university) using the INSTEP link. This involved undertaking experimental work at A-level.

I continued to press for recording of the trainees, but this facility was never made available.

4.3 Academic Year 2006-2007 (Project Year 3)

From September 2006, all six schools were fully connected and able to use the INSTEP technology. Two schools provided the main opportunity for remote lesson observation or joint activity with a third offering occasional use. Three of the schools did not use the technology with their trainees, nor did they provide lessons for remote observation. Thus the equipment in these three schools was not used for the entire academic year.

4.3.1 Trainee Interviews – June 2007

Two cluster group interviews were conducted by the external evaluators and the transcripts were made available without analysis. I undertook to interview a third cluster group. The interviews were conducted with trainees who had one or both placements in schools that had the INSTEP technology. The first group had two trainees and the second three trainees. My cluster group had three trainees.

All eight trainees indicated that their choice of this university for their PGCE was related either to them living in the area or to having undertaken their first degree at the university. None were influenced in their choice by the facility of the INSTEP technology, three indicating that they had never even heard of it.

The trainees reported that they were informed about the INSTEP programme in the general introductory lecture. With regard to how the INSTEP technology would be used, only one trainee expressed concern. He said,

> "If I'm brutally honest, I have anxiety about anything where cameras are concerned anyway, especially when it is web based – that's just me"

However, all stated that they had been reassured about the way it would be used. They had been informed that only certain people were authorised to view lessons and one went on to say that there comes a time when you are not aware the cameras are there. This confidence was confirmed at the end of the PGCE programme.

All the trainees interviewed were positive about the use of the INSTEP technology when at the university. However, the use of the technology in school was less well received.

These trainees identified a number of ways that the INSTEP technology was effectively used when they were based in the university. These included:

1. The opportunity to have contact with the Head of Science at a placement school prior to the school visit;
2. The opportunity to observe what happens in other schools and see the expertise of other teachers.

3. The ability to support lectures and seminars by a live observation of the principles discussed.

4. The trainees reported that opportunities were given for them to speak to and question the teacher after each session. However, the immediacy of these opportunities tended to result in superficial questions; whereas had there been time given for reflection of the activity, the quality of the trainee's learning experience would have been enhanced.

5. Having the tutor team commentate on the lesson being observed. One trainee made the point that they didn't have the experience to know what to look for in lessons and so to have one of the core tutor team commentate on what was being observed made it more focussed.

Two further areas raised by the trainees related to remote observation of lessons at the university. The first related to "difficult" classes. The opportunity to observe either trainees or even experienced teachers work with classes that are difficult would be of value. This was further amplified by one of the trainees interviewed, who noted that most of the lessons observed were focussed, and the planning had timings attached. What he wanted to see was how a teacher responds when the unforeseen occurs, and the strategies employed to remedy that.

The second issue was that of remote observation. These trainees recognised that to have a group of PGCE students observing a lesson has an effect upon the dynamic and ethos of the group. However, as one pointed out, watching a lesson via a camera link removes the possibility of seeing the whole classroom, thus increasing the possibility of missing peripheral pupil activity.

All eight indicated that they were not formally observed using this equipment. One of the trainees indicated that he had been observed from the university but that he was not aware of it at the time of the observation. This was the only use reported by these trainees.

One of the cluster groups was asked to comment on the attitude of the teachers at two of the schools with INSTEP technology. In both schools there was a reticence to use the

equipment, and one school INSTEP co-ordinator was described as a technophobe. The trainees were expecting the equipment to be used while they were in school. When asked whether they felt they had suffered as a consequence, none made a response. Rather they offered areas of expectation, e.g. observing other teachers in other INSTEP schools and taking it in turns to observe a co-trainee when two are in the same school.

One of the trainees spoke about observing a lesson taught by his mentor. This was in the period October – December during the 3 day / 2 day (first school placement / university) split before the block placement. He noted that the mentor's behaviour did not change as a consequence of undertaking a live lesson. Additionally, because the cameras are discreet, there was no impact on the pupils.

Additional comments made by the trainees in these cluster groups included:

1. Most wanted the facility of having their lesson recorded. The opportunity for reflective observation was seen as important in that areas for development can easily be seen. The one student who was initially cautious about using cameras expressed his anxiety of the additional pressure this would bring upon his teaching;

2. Frustration with the technical side of INSTEP. Instead of being able to walk into the laboratory and immediately teach, the trainees noted that the microphone had to be put on and also there were times of technical difficulty;

3. In one of the schools the cameras were in a computer suite rather than a dedicated laboratory thus preventing observation of practical work.

4.3.2 Mentor Interviews (June 2007)

Individual interviews were undertaken with seven mentors. Three of these mentors were in INSTEP schools and had participated to some degree with the university tutors in making their lessons available for observation. Additionally four who worked in schools without the INSTEP technology also participated. Mentors in the three INSTEP equipped schools who had not participated did not respond to requests for interviews.

Those interviewed varied in the length of their experience as mentors with four having been mentors for three years or more. Two of these had experience of being mentors on Science PGCE programmes led by other Higher Education Institutes.

There was no reported pattern regarding mentor training. Responses ranged from (1) having no training (two mentors including a mentor with only one year's teaching experience), to (2) having just generic training provided by the university to (3) having generic training plus ad-hoc input in mentor meetings to (4) having the generic training plus additional subject specific input from the PGCE Science tutors. Three of the mentors stated that they were being coached in this role by experienced colleagues within their own schools.

The effectiveness of the generic mentor training was described by words such as re-assuring, satisfactory and adequate. It was effective when specific issues were addressed (e.g. matching the trainee to the standards, how to write placement reports) or activities undertaken (e.g. joint lesson observation).

The general view was that it did what it was supposed to do. One mentor commenting about the training said,

> "Mainly it was to give you an idea of the standards and what your role was in trying to make sure your students achieve those standards, so it was mainly just in terms of what you had to do with the assessments. I don't think it really dealt much with what the mentors had to do. I remember watching some videos of different subject areas showing how different mentoring interviews would talk to the students afterwards as feedback ".

The issue of the training not dealing with the practice was reflected by two other mentors. Both expressed anxiety of not really knowing what to do during their first year of mentoring. One of the experienced mentors described support in the science mentor meetings as "haphazard". Asked about training in the context of science mentor meetings he said,

> "I think if I was someone new coming to mentoring I would have found it a bit overwhelming in terms of what you have to do as a mentor but, as I've been a mentor before, I was able to just apply what I had done before; but as someone

> who was brand new to it, I think you would need a lot more input about exactly what you have to do. It was a little bit unstructured and there doesn't seem to be any accommodation for someone who is coming in completely new to it".

Several of the mentors spoke of the advantage of having experience. This enabled them to understand the standards and how to assess, as well as to know what is required in the day-to-day support of a trainee. The three least experienced mentors had all found support from experienced colleagues. It wasn't clear, however, whether this had evolved naturally or was the policy of the particular schools. Working with experienced colleagues in school has an advantage. One mentor spoke of improving his observation skills, whilst another described the opportunity of being able to undertake the administrative side of mentoring without the pressure of knowing what to do next.

The use of the INSTEP technology did not form part of the mentor training. One of the mentors reported one mentor meeting where they observed lesson observation feedback being given to a trainee. This was the only reported occasion where the technology was used to support the practice of mentors.

All the mentors interviewed spoke of being updated on the use of the INSTEP technology but, apart from those schools involved, it had no direct bearing on training or practice. It has been information but not training. Use had only been made by the trainee body observing lessons or activities remotely from the university.

Although there was no pattern to describe mentor training and there was no input into mentor development by using the INSTEP technology, each mentor undertook the role seriously and for the primary benefit of their trainees. One mentor did speak of mentoring as part of his professional development and thus an important feature of his career development profile; but this was clearly secondary to supporting the trainees.

In response to the question of how mentors communicated their practical knowledge of teaching to their trainees, the following two themes emerged – both resulting in reflection, discussion and planned further action:

1. Through observation – all the interviewed mentors expected their trainees to observe a variety of different teachers, particularly on their first placements.

Checklists or specific issues for observation were produced by all these mentors, for as one mentor suggested, without such the trainees don't really know what they are looking for. A common view was that, by observing a variety of different teachers with a variety of differing teaching groups, a wide range of teaching styles and strategies would be seen. This would enable the trainee to draw from the range rather than just model his / her style on the mentor.

2. By sharing in lessons before taking over whole classes – co-teaching has the value of immediacy in communicating practical knowledge. Additionally, one mentor described the process as being like learning to drive with the mentor being like the driving instructor.

The partnership between the university and schools and between schools was generally seen as positive and supportive by all the mentors interviewed. The particular strengths were the accessibility and availability of the university tutors and the relationships between and mutual support of the school based mentors. One mentor spoke of having access to a visit of a more experienced mentor.

The main area of concern raised by these mentors was the lack of consistency between mentors. Two areas were identified:

1. One was where a trainee was undergoing difficulties and was in danger of being placed "at risk" at the end of the first placement. There was a feeling that some mentors were too generous in favour of the trainee and thus effectively placing the burden upon the mentor in the second placement school.
2. The other was in the day to day support of the trainees. Trainees experienced varying levels of support through different schools from their mentors, and from the professional tutors.

None of the mentors raised the use of the INSTEP technology in supporting the development of the partnership.

The mentors interviewed were mixed in their views as to whether the trainees are better prepared now for teaching practice, compared to those trainees three years ago before the INSTEP programme was available. Responses ranged from "Absolutely so", to "Definitely not".

The difference in perspective arose from a view that trainees (1) either get to see what they are about to experience, and in that sense it is less of an unknown, or (2) believe that it depends upon the individual trainee and whether or not they have potential. But all of them agreed to the value of the trainees observing live lessons prior to and during the first placement during the 3 day school / 2 day university split.

With regards to the equipment, all three INSTEP school mentors indicated that the equipment was unobtrusive and one went on to say that the pupils soon become oblivious to the presence of the cameras.

The issue of recording lessons both for the trainee to self-evaluate and for discussion within mentor meetings was raised by all three INSTEP school mentors. All three wanted to use that facility and frustration was expressed at both the technical difficulties in enabling this to happen and the policy of only being able to view the recording on an INSTEP laptop. One of the mentors said in answer to the question about recording lessons,

> "I haven't but I would like too. I know everybody has had it explained to them that, if something is recorded then it's the property of the person recorded and their property only. You can only watch it on the INSTEP laptops, so you can't just tape it and watch it somewhere else. I think at the moment there is a little bit of apprehension."

In terms of the INSTEP facilities changing practice, the three mentors concerned indicated that apart from a little extra preparation for the lessons observed remotely at the university there had been no changes whatsoever. The additional preparation was in order that the teacher would do his best when being observed.

All the mentors were asked whether there would be anything they would change regarding the INSTEP programme. The issues raised included:

1. The equipment being placed in different rooms (raised by two of the INSTEP school mentors). One stated that the equipment was in a computer / demonstration room rather than a laboratory whereas the other noted that the equipment was in the room of the subject leader who was "not into INSTEP at all";
2. More should be made of the recording facility in order to more effectively discuss classroom performance. The view was expressed that trainees should have a DVD of their lessons which could then be used for reflection, discussion, target setting and subsequent performance enhancement;
3. The facility should be used for mentor training.

4.3.3 University Tutor Interviews June 2007

Two of the tutors were interviewed separately at the end of year 3. These interviews focussed on the following issues:

1. Their perception of the role of the partnership between the university and schools in ITE
2. Their use of the INSTEP technology in initial teacher education
3. The benefits, limitations and changes brought about by the introduction of INSTEP upon themselves
4. Their perception of the impact of the INSTEP programme upon trainees

In response to the role of the partnership both tutors spoke about the role of the mentors. Both recognised the diversity in experience and practice that the mentors offer and suggested this enhanced the trainee experience by appropriate placement.

In terms of supporting the trainee teachers both alluded to the relationship between theory[26] and practice. As one remarked,

[26] Discussion with and observation of two of the university tutors led me to interpret their view of 'theory' as a version of the 'living educational theory' described by Whitehead (1998). In its simplest form it asks in a reflexive manner, "how can I improve what I'm doing?" This is in contrast to the more detailed view described on p31.

> "it is successful where teachers in schools know what we're delivering from a theory perspective and they provide the practice that matches into that theory."

The role of the mentor was discussed along with how that role was supported by the tutors and, in particular, using the INSTEP technology. Mixed messages were conveyed about the mentoring role. This ranged from the 'expert coach' to the danger of the mentor 'cloning' their trainee.

It was recognised that mentor training could be enhanced. One of the tutors stated,

> "The so called science mentor training meetings are mainly information giving more than discussion, so I don't think there is sufficient training going on."

Nevertheless he acknowledged that there had not been any use of the InSTEP technology in supporting mentors. He added,

> "This is where we see INSTEP playing a crucial role in Phase 2[27] where teachers will record their lessons and so I would expect mentors to apply the same critical evaluation of their own practice as they would to the trainee's practice."

The use of the technology was limited due to the lack of pedagogical training in the use of INSTEP. Only technical training was available. One of the tutors further commented upon an aspect of the impact of INSTEP by saying,

> "The biggest thing with all users of INSTEP is that it makes them scrutinise their own practice – it causes them to reflect. It's really about driving professional development of both mentors and trainees."

The tutors were asked about the use of INSTEP with the trainee teachers. Their view was it enabled an immediate link between theory and practice, the trainees were able to have a dialogue with their peers and as a consequence become better reflective practitioners.

[27] The tutor had described the next phase of development of INSTEP as Phase 2. This was envisioned as having a bank of recorded 'best practice' lessons for CPD and ITE use

The InSTEP facilities were used when the tutors have felt that the subject under study was either too difficult to demonstrate in the classroom or where it would enrich the trainees' experience. As one commented,

> "We can describe it and almost tell them how to do it, but telling isn't the same experience as seeing An example is assessment for learning where we had some of the Badger levelling tasks with the author present. We did some levelling tasks and what the trainees gained was a full and frank discussion between the author of the tasks and the teacher using the task."

In terms of adding value to the trainee teachers' experience InSTEP was believed to disabuse some of their misconceptions about schools – "if they've seen it, it doesn't hold any mystery for them."

Using the INSTEP technology appears to change the practice of the tutors. One commented that,

> "You change from being a passive deliverer of theory to being a proactive interpreter of practice with respect to the theory – and as one of the team said you turn into a "Murray Walker". You have to have a very secure grasp of the theory before you can deliver an effective INSTEP session because it is a question of being opportunistic; but it's also the ability to take in a whole range and say, for example, why is that teacher using that teaching method – let's explore what they could have done instead, and then gone into discussion afterwards and asked the teacher why they did that and was there another approach that they had rejected."

The tutors were asked to indicate how they saw the project developing. They expressed the view that both consolidation and expansion were the ways forward. Consolidation was seen in terms of using INSTEP equipped schools as hubs for delivering CPD. One of the tutors commented:

> "CPD will work best when we can really get the hub working ... the advantage of INSTEP for CPD is that they'll be able to integrate it much more easily into their day and the fact that they can record it. At the moment, they can only

> record[28] it at this end, but later they'll be able to record it themselves and watch it later."

Expansion was seen in linking with other HEIs and their partnerships.

A final comment was made by one of the tutor team. He said at the end of the interview,

> "INSTEP has exceeded my expectations. I didn't anticipate it would provide as much enrichment as we have. Looking at what INSTEP is producing, my problem is the groundswell- seeing what is happening on the ground as I'm somewhat insulated from it. My focus in phase one has been on ITE and I've only just started to look at the implications for CPD which will be the next phase."

4.4 Subsequent Interviews / Data Gathering (Year 4 after the Project had come to an end)

In order to explore further the relationship between matching theory with practice, analysis was made of a video recording designed to show aspects of the use of INSTEP in initial teacher education. This was then followed by interviews with the lead science tutor, another university tutor and two former trainees - both in their NQT year.

4.4.1 DVD – Evidence (recorded February 2007 and made available in October 2007)

A video recording was made of two parallel INSTEP teaching sessions. The first seminar was on classroom management and the second focussed on lesson planning. In both teaching rooms there were two interactive white boards. On one was the theoretical presentation (in both cases by a PowerPoint presentation) and the second was the direct live link into the school.

The session on behaviour management was drawn from the work of Bill Rogers. This looked at classroom control but with a particular emphasis upon the behaviour of the teacher. The tutor related theoretical aspects of behaviour management (undertaken earlier

[28] This contradicted all other comments made in the mentor steering group meetings about being able to record

in the session) to what was being observed live from the classroom. Specifically the tutor gave commentary on getting the starter activity underway before the register is taken, on how the teacher walked purposefully around the classroom and re-focussing pupils back to the set task. Additionally the tutor was able to identify two misbehaving boys and so he zoomed in on the pair and drew the group's attention to how the teacher assertively intervened.

Whilst this was happening the trainees were undertaking a variety of activities including taking notes, group discussion and listening to the tutor's comments. After the class session had finished the trainees were able to ask questions of the teacher involved.

The second session covered lesson planning. A structured workshop had taken place immediately before the live lesson. Guidance was given to the trainees by the tutor of what to look for during the lesson. This included the shape and structure of the lesson and the managed transition point between activities. This was matched against the formal lesson plan emailed to this seminar. Commentary was given as the lesson proceeded and the software was manipulated to zoom in and out of specific circumstances. Again the trainees were able to talk to the teacher.

4.4.2 Interview with 2 University Tutors – April 2008

The two tutors were interviewed separately and their comments combined:

Can you tell me how you integrate the theory trainees need with their professional practice?

The theory aspect of the programme preceded and was interwoven with live INSTEP broadcasts. In our planning we would look at the week by week programme and see what was coming up, say for example behaviour management or some aspect of assessment for learning. We would then look at the INSTEP slots and ask how these issues can be exemplified with the INSTEP schools. The schools would be contacted and made aware of our focus. We ask for their lesson plan and then structure our teaching around the lesson. After scrutiny of the lesson plan our PowerPoint presentation of the theory is amended. The sessions begin with theory before the lesson – the underlying principles are developed and

then we go live. Our task is to give a live narrative and to spot what happens. We prepare the students for the live session – they are asked to write down what they see, to make links with the theoretical and ask how did things match up. Where value is really added is when the trainees are able to talk to the teacher straight after the session and discuss some of the issues they had seen and ask why the teacher did things in a particular way.

4.4.3 Interview with Two Former Trainees – April 2008

The two former trainees (now undertaking their NQT year) were interviewed together and are designated 1 and 2.

Tell me about the theory you encountered on the P.G.C.E. course

1. There was a lot of it. The main stuff - that done with all the other students didn't appear very relevant but when we did it again back in Science it became more relevant. We were in a smaller group and there were more opportunities to ask questions. A lot of it goes over your head until you do it in practice. Theory only goes so far until you experience it.
2. Doing the theory as a whole cohort was better, they seemed better prepared. As for the Science stuff - I think this was done better by the mentors in school.

What do you understand by theory?

1. Things like why and how we do practical work, literacy, numeracy, how science works, special needs, CASE, behaviour management. To be honest, some of it didn't seem relevant until I went on teaching practice.
2. We talked about learning styles and theories of learning but these were never applied. The sessions were too short.

At what point in the programme did you cover it?

1. The theory was covered in the early part of the course through lectures with students from other subjects and also just as science trainees. The order was about right.

2. I would have liked to have had the stuff on behaviour management earlier in the programme. Numeracy and literacy could have been left until later.

How does the theory relate to your classroom practice and give examples of the relevance of the theory

1. At the time I thought it was nonsense. Why were we thinking about Piaget? There was just too much information: What I needed was my mentor to push me to do it in practice, otherwise it was just difficult
2. Actually it was difficult on practice. Even though we had considered year 6 to 7 transition and had done levelling activities, it was still hard in practice. Having said that, I would like to go back and do the theory again. It will make much more sense having seen it in practice. I would now like to reflect.

How was the theory covered?

1. Mainly through PowerPoint presentations although we did have two assignments to write. CASE was better as we did some of the practical activities before we covered the theory.
2. We also saw some of these things live through INSTEP. I guess it was about 50/50. When it worked it was very good but sometimes it just didn't. It worked best when it was well planned but often it was just on in the background and we dropped into sessions and-when something interesting appeared to be happening. We were told, "Let's look at that," but that was disjointed. Just occasionally you got a good idea.

Was there anything or anyone else on the course that helped you relate the theory to practice?

1. The biggest help came from the teachers in school. The professional tutors, mentors and the other teachers in the department all helped to make the theory link with what I was doing.

Is there any other use of the INSTEP technology that would have helped you?

1. For lesson planning. We only ever saw small snippets of lessons. It would have been really helpful to see a whole lesson with PowerPoint prompts and support from the tutors. Talking to the teacher in the school afterwards was useful, but it was limited by only seeing a few moments of the lesson.
2. I wanted to have my lessons recorded and then go back and look at it again. I think I would have learned so much about myself. The problem with INSTEP was that it was not always delivered well and there seemed to be no alternative if it didn't work.

Chapter 5 – Analysis of the Findings

It is important to recognise that INSTEP, was just one component, albeit an important component, of the Science PGCE as a whole; and it was designed to complement and enhance existing PGCE provision. Student teachers who participated in the project also took part in other, non-INSTEP learning activities. Thus INSTEP should be seen in the context of an initial teacher development that would presumably have been taking place as a result of other activities offered by the PGCE team. Hence, whilst there has been an attempt to present examples of where it is felt that INSTEP made a particular contribution to student teacher learning, there could be no claim that all the learning observed was solely the result of INSTEP activities. It should also be noted that, although particular emphasis is given here to the impact that INSTEP made during the first part of their PGCE programme[29], the evidence suggests that INSTEP can also contribute to teacher development during later stages of teacher preparation, into their first year of teaching and beyond.

5.1 Benefits Gained from INSTEP

The research question that I was able to investigate was, "what impact, if any, does INSTEP contribute to supporting trainees through their ITE programme, preparing trainees for their placements and helping them to gain Qualified Teacher Status and become better teachers?" The data points to INSTEP enhancing the PGCE programme and supporting the trainees in several areas:

1. Linking theory to practice through both the contextualisation and de-contextualisation of observed activities in school lessons;
2. Supporting the professional learning of the trainee science teachers by facilitating reflective practice, supporting collaborative learning and indicating the development of professional language.

[29] The INSTEP technology was used for whole science trainee cohort teaching in the period prior to the first placement, during placement one when the trainees were on the 2 day (university) / 3 day (school) split and also during the inter-placement period.

5.1.1. Linking Theory to Practice

Three related but distinct aspects of activity in INSTEP sessions have been identified on the evidence of the data to have contributed to the integration of theory and practice elements of student teachers' learning. The INSTEP technology appears to be a mechanism to support the framework noted by Alsop et al. (2005) as being required to bridge the theory-practice divide.

The first type of activity can be called *contextualisation*. INSTEP sessions provided student teachers with examples of practice which illustrated and reinforced previously introduced theoretical themes. In this type of activity, INSTEP-mediated observation was used by tutors to juxtapose theoretical and practical elements with the student teacher being encouraged to make connections between theoretical ideas introduced in the university teacher education classroom and elements of observed school classroom activity.

INSTEP was used to contextualise theoretical notions associated with assessment for learning (AfL). The effectiveness for student teachers undertaking this taught session was apparent from responses given in the student teacher group interviews where all three groups independently gave this as an example of a theoretical area where they felt INSTEP sessions had contributed to their learning.

> 'The one thing that stands out was AfL. At the start, they were talking about AfL, and nobody knew what was going on and then we watched a teacher teach a lesson [through INSTEP] that was purely AfL and he was answering the questions that we were asking; and we were like, 'Oh that's it!' … you can learn the theory but when you see it happening, it really comes to life for you'

Another example of contextualisation came from one of the INSTEP sessions primarily concerned with lesson planning. A university tutor-led workshop session had taken place immediately before the INSTEP lesson and student teachers were offered guidance on what to look for during the lesson. This included the shape and structure of the lesson and the management of transition points between activities. Observation of the INSTEP feed was matched against the formal lesson plan which had previously been e-mailed from the school to the University. A tutor gave a commentary whilst manipulating the image

software to focus on specific features of the lesson; and the student teachers were able to talk to the teacher after the lesson. This discussion in the context of real and observed practice enhances the integration of theory and practice (Sweeney, 2003).

INSTEP also enabled a second complementary and, in a sense, inverse process of *decontextualisation*, where examples of classroom practice experienced by student teachers through INSTEP were given a more generalised, theoretically influenced, interpretation by university tutors focusing student teacher attention on aspects of what was taking place. Two of the tutors described this process as analogous to offering an expert commentary on classroom activity, a challenging new development of the university tutor's role for which working with live material in this fashion was in some ways an inherently unplannable activity. Examples of this process were given by student teachers in one group interview and in one mentor interview. The value of this activity for student teacher learning seemed to lie in the immediate juxtaposition of practical activity and theoretical perspective, through linking particular individual observed actions and behaviours to general principles.

Additionally INSTEP appeared to support the development of the abilities of student teachers to *observe* classrooms. Whilst it was possible to isolate examples of what is described above as contextualisation and decontextualisation taking place in sessions involving INSTEP, it was clear that these processes did not always take place separately and distinctly. Indeed, in some of the most effective INSTEP sessions, an interactive dialogue was established between theoretical ideas and examples of practice drawn from contemporaneous classroom observation, collectively experienced by student teachers, supplemented by a commentary from a university tutor and, in some cases, by interaction between student teachers and the teacher whose lesson had just been observed. In such exchanges, contextualisation and decontextualisation were both apparent in a context where a range of 'authentic' classroom activity was interpreted and discussed. Theory and practice seemed to flow into each other. Neither was it always necessarily obvious to student teachers at the time that this linking of theory and practice was taking place: from their perspective, and from that of others involved in supporting the learning of these students, it was their capacity to observe classrooms that was being enhanced in INSTEP sessions. The

technology thus offered a means of addressing student teachers' lack of familiarity with school classrooms at the start of their ITE course.

University tutors, school-based practitioners and student teachers themselves were all asked how they felt the use of INSTEP prior to their first experience of teaching had contributed to student teachers' preparation for their first teaching practice. In all the interviews with university tutors, five out of seven of those with mentors, and in two of the three group interviews with student teachers from year 3, the view was expressed that student teachers' preparation for their first teaching practice was enhanced by INSTEP sessions because their ability to observe classrooms was improved. The trainees were also able to observe classroom events that were ephemeral and difficult to discuss in the absence of the live observation.

Only 12 of the 29 respondents in the year 2 cohort said that INSTEP had been of value in this respect, presumably because of the technical difficulties being experienced at this stage of the project.

Part of the value of INSTEP in such activities was the way it offered tutors a resource whereby groups of student teachers could simultaneously observe the same classroom. This appeared particularly powerful in developing student teachers' observational skills when university tutors used a process of guided observation in the course of two INSTEP sessions prior to their first placement. In these sessions, alongside guidance notes for lesson observations, student teachers were taught how to construct a timeline of events, how to note the different aspects of the lesson, how to observe the transition from one activity to another and how to record both teacher and pupil activities. These techniques were then built on by the mentors during student teachers' school placements later in the PGCE course.

5.1.2. Supporting the professional learning of the trainee science teachers

The INSTEP environment also appears to have supported the professional learning of the trainee teachers through developing reflective practice, collaborative learning and

pedagogic language, all of which are identified by Bishop and Denley (2007) as important parts of the induction process of learning science teaching.

5.1.2 (a) Reflection

Experienced teachers play a crucial role in supporting their new colleagues' initial training. Acquiring the skills necessary to transform a teacher from novice to expert requires the involvement of a mentor or coach who can help bridge the gap between theory and practice and highlight that which is tacit and appears hidden (Harrison et al., 2005). Working alongside experienced teachers allows the trainee to observe, listen and participate in activities. In doing so they learn new practices and perspectives, become aware of different types of knowledge and expertise and gain some insight into experienced teachers' tacit knowledge (Eraut, 2007b).

An example of where INSTEP supported this process came in the context of team teaching. Supported by their mentor in school, two trainees on a paired placement team taught a group of year 9 pupils. A tutor reported:

> "In the second year we did a session on team teaching. Now we've done that in the past using PowerPoint presentations but it never really made any impact. A teaching session was arranged to consider team teaching in school. Four of the trainees watching this were in serious difficulty in their placement school. When they saw the INSTEP session they individually came and said we now know what you're talking about – we can do this – and for three of the trainees it turned their practice round. That's very powerful"

It is one thing to be exhorted to reflect, it is another to become a reflective practitioner (Bishop and Denley, 2007). Reasoning from a pedagogical perspective does not necessarily come naturally to those starting a teaching career. Although they might lack an extensive teaching repertoire at this early stage of their professional development, they can still exhibit the desire to think, consult and enquire about their practice.

INSTEP was also used to contextualise pedagogic principles, linking them to observed classroom practice in a way that facilitated reflection. Using the INSTEP

technology to develop professional learning through supporting reflective practice has also had an effect on the way the university tutors approach their teaching. The impact of INSTEP is to transform the focus of a teaching session from delivery to interpretation as the tutor becomes an expert commentator.

5.1.2 (b) Collaborative Learning

In the course of their Initial Teacher Education, trainees develop their learning through their participation in different and distinct communities of practice (Borko et al., 2008, Lave and Wenger, 1991); and the professional learning that takes place in these communities is related to, though different from, reflective practice. The primary settings for these communities of practice are the university and the partnership schools and both potentially offer opportunities for integrating practice with the knowledge, philosophies and attitudes of the professional teacher (Walkington, 2007). The critique of some (Eraut, 2004a) is that the connections between the two communities of practice are not always obvious nor made obvious to trainees who often emerge from their ITE with something of a dualist view in which educational theory is associated with the university classroom and educational practice with the school setting (Hascher et al., 2004).

The distinctive contribution that technologies such as INSTEP offer in this context is that that they have the capacity to facilitate participation in both communities of practice. Within the university setting, the observation of live, 'authentic' (Brophy, 2004) classroom activity, combined with the inputs of experienced tutors supports the development in the teacher education classroom of lively, reflective and theoretically informed peer interaction. In this way, the teacher education classroom can become a rich learning environment in which a vibrant community of practice develops as trainees are exposed to, and have the opportunity to interact with, a wide range of teachers' practices. At the same time, these activities help trainees to develop their ability to observe classrooms (Sherrin & Van Es. 2009), an important dimension of early professional learning and a significant element of the legitimate peripheral participation of teachers (Lave & Wenger 1991). Trainees who have developed such skills through access to this form of interactive video-enhanced observation could be better prepared to undertake and learn from school-based practice.

Thus INSTEP and similar technologies, used in the way outlined here, have the potential to develop trainees' participation in both types of community and, crucially, to offer a means of linking and bridging those two contexts and their associated communities of practice.

Regarding this aspect of peer interaction, one trainee said,

> "You look at a classroom together as a group. You discuss what has been taught and what has been seen together. People ask questions you hadn't even thought of."

Coyle (2004), noting a similar effect from the University of Nottingham Teaching and Learning Observatory, suggested that multiple perspectives are being made available to the trainee teachers that go beyond observing experienced teachers at work. These outcomes appear to be consistent with what Holmes et al. (2001) call communal constructivism whereby tutors and trainees collectively discuss, analyse and deconstruct observed practice.

5.1.2 (c) Pedagogic Language Development

The early stages of a trainee's career are marked by an introduction into the language of pedagogy; and using this language is a "characteristic of apprenticeship in joining the community" (Bishop and Denley, 2007). INSTEP affords many opportunities for the development of this language through peer dialogue and the expert commentary and support of the tutor. This agrees with the understanding of Brophy (2004) and Eraut (2004c) who note the importance of developing a discourse in order to reflect and discuss how practice is conceptualised.

5.2 Curriculum Enrichment in Schools – An Unexpected Gain

An important feature of the PGCE Science programme is the post-16 training. This occurs in the period between placements one and two. INSTEP was used to provide a different dimension (described by the tutor team as 'Showcase Activities') to the traditional teaching programme in two distinct ways:

1. By trainee science teachers undertaking short teaching sessions based upon A-level topics such as genetics. The trainee teachers were in the university teaching room and presented to sixth form pupils at a distant site in a partner school;
2. By the synchronous teaching of sixth form students in a school and science trainee teachers at the university by the teacher in the school. In the first year this was an extended A-level Chemistry practical and in year two an extended Physics practical.

In both years the first activity-type was less successful partly due to technical difficulties but also due to the lack of focus of the trainees. The trainee teachers were given a broad topic area and invited to undertake a 10-15 minute presentation. However, progression and topic sequencing were not integrated into this framework.

The second activity-type was more successful. These were led by teachers in partner schools whose focus included an extended practical activity for their own pupils (rarely undertaken due to school lessons being typically of one hour duration) and the simultaneous teaching of the trainee teachers on how to prepare for and undertake A-level practical activities. This extended practical activity is identified as curriculum enrichment (DfEE, 1998) for added depth. Characteristically it fits alongside standard provision and it promotes deeper understanding of the core material and a higher level of technique. Such activities support and extend pupils' learning of science and as such are part of the process of raising attainment (Dengate and Hoyle, 1998). One sixth form pupil illustrated this by commenting:

> "We were able to do a full length practical without having to stop after an hour. My practical skills have improved enormously – I wasn't panicking as much as I usually do, as there was plenty of time to carry it out. I found that after getting stuck into the practical I forgot that we were even being watched and that the cameras were even there."

5.3 Missed Opportunities

Although INSTEP appears to have made a positive contribution to development of the trainee science teachers, the data suggests that INSTEP was under-utilised, so opportunities

were missed. This, I believe, contributed to the inability to explore the second and third research questions. Specific examples are identified below.

5.3.1. Leadership and Management of the Project

INSTEP had its origins from a time when, due to the redevelopment of university facilities, the science education component of the PGCE programme was delivered in a partnership school. This afforded opportunities for the science trainees to observe teachers first hand before undertaking their first teaching practice. Its beginnings were consequently based on pragmatic and commonsense principles rather than any research evidence (Millar et al., 2006). However, while the project team hoped that INSTEP would provide a template for training type interventions that would work in a variety of settings (e.g. ITE, CPD, collaborative training across HEIs), there was no development plan to guide it. Minutes of the mentor steering group reveal serendipitous evolution rather than iterative development. This is a pity because INSTEP had the potential to offer a model of the research-practice interface in which professional insight, engagement and reflection had a central role (Millar et al., 2006).

An examination of the way the project was managed provides some insight as to why some of the original aims (Briefing) were never addressed. I have placed these in three major groups. A fourth group involving mentors is described separately in section 5.3.2 .

5.3.1a Leadership Strategy

Throughout the lifetime of the project, its single focus was that of supporting the tutor's teaching of the trainees at the university. This had some measure of success. There were two action plans describing the anticipated key points or milestones of the project. One was available to the university steering committee and the other, with a different emphasis focussing primarily on the tutors' teaching, was privately considered by the tutor team. Neither was seen by the mentors. Thus the need for implementing this initiative was never articulated. There was a lack of clarity in the objectives, the mentors had little influence on

the small university team and a turnover of key individuals (albeit for professional development reasons) also militated against the success of the project.

The approach to implementing this innovation was directive rather than collaborative or consultative (Lynch and Roecker, 2007). Instead of "getting people to move in the same direction" (p145), several important mentors were not engaging with INSTEP. Thus any gains that could be attributed to INSTEP required a high degree of commitment from what became to be a very small group of mentors.

From mid-way through year 1 to the end of the project mentor meetings were dominated by being told how the technology was going to be used and what aspects of theory and practice would be covered. Thus the warnings of extolling the merits of the technology (Scott and Robinson, 1996) were ignored and the impact of the project was talked up (Darra, 2008). The disenchantment of some mentors was not considered. The effect of the tutor team reminded me of Busher's (2005) warning of the power to shape things arising from the projection of personality.

This, perhaps, gives some understanding of the divergence in views between the tutors and mentors when regarding the effectiveness of the project. The tutors had their practice enriched by having the ability to illustrate and promote both reflection and discussion of complex classroom situations as described by Brophy (2004) and van Es and Sherin (2010); but there were no parallel benefits for the mentors.

5.3.1b Engagement With Research

At no point in the steering group meetings was there a discussion of how the project might be informed from the findings of available literature even though the external evaluators included a review of the available literature in this area in an early interim evaluation report (February, 2006). The importance of integrating theory with practice and evidence (Lueddeke, 1999, Everard and Morris, 1985) has already been noted but there was no evidence that the work reported elsewhere had ever been considered. While access to the

University of Nottingham Teaching and Learning Observatory was made available by the external evaluators, a visit by one of the tutors resulted in the comment that:

> "It has ossified over the last 6 years. It is old technology only used for a specific purpose".

This is in sharp contrast to Coyle's (2004) findings where real benefits were identified.

It is worth noting that the benefits of asynchronous recording were available to the tutor team at the time the project began. Sherin and Han (2004) had reported on the impact of the Video Analysis Support Tool (VAST) and Hopkins (2001) had written about the effect of video recording for coaching teachers regarding teacher-pupil interactions.

Moreover, none of the tutors considered the potential of InSTEP for their own research.

5.3.1c Technological Issues

There were technical challenges throughout the lifetime of the project that might have been managed differently. Email correspondence in year 1 indicated that some members of the university steering group believed that additional technical support was needed to get the project off to a good start. This was rejected by the lead tutor. Nevertheless it required additional intervention at the beginning of year 2 to enable testing and broadcasts to occur. Sound was problematic throughout. The software required was developed internally without the expected support of a commercial provider. In the Spring of Year 3 the team advertised a fully developed version of the software that enabled recording and DVD burning. However, the product was unstable and recording was never undertaken.

There is no evidence that the extent of the difficulties were shared with either the university steering group or the mentors. Rather, what we heard was a talking up of the project which in reality was a form of deceptive discourse (Darra, 2008; Eraut, 2004c).

5.3.2. Mentor Involvement

A number of studies (Walkington, 2007, Su, 1992, Hagger and McIntyre, 2006) point to mentors providing a powerful means of integrating university and school components of trainee teacher education. There was evidence that some mentors were not fully engaging with the INSTEP project even when they had stated they were committed to the project. Two factors are important. First, mentors do not often assist trainees to acquire an understanding of theory, but work to assist their trainee teachers develop polished classroom performances (Edwards & Protheroe, 2003). Second, a lack of pedagogic training related to INSTEP led to an uneven pattern of practice. It is important to note that, while not all the mentors interviewed were fully engaged with INSTEP, they were all committed to their trainees. Rice's (2008) comments about mentors being made familiar with both partnership and assessment requirements, rather than being helped to support their trainee's theoretical understanding, is applicable. This suggests a missed opportunity, particularly with the potential of INSTEP to support communication between school and university.

The mentor steering group initially held the view that they would be supporting the development of INSTEP by sharing ideas and examples of practice and also discussing how it might be used in school. Our initial mood was a willingness to develop our practice and become more involved with the ITE tutors. However, the tutor team lacked engagement with the mentors. INSTEP was not used to enhance mentor practice, and requests for recording were told that 'it's not possible at this time'. INSTEP only featured in mentor meetings when mentors were informing them of future usage and events. There was no sense of partnership, no discussion of pedagogy and no training. The effect was to militate against the development of a professional learning community of mentors who could share their practice and undertake collective professional learning in a reflective and collaborative manner (Stoll and Louis, 2007). Had this been facilitated by the tutors it is possible that the mentors would have engaged in producing new knowledge through the discussion of their experiences of INSTEP.

Contrasting views between the tutors and mentors were identified from the interviews. The tutors held the view that the project had played a role in strengthening and developing the partnership links. This is seen in the following statements:

> "INSTEP certainly consolidates partnership. Schools like the fact they're being consulted and valued for their expertise and that in itself is very valuable."

and

> "It's a cultural change which creates a mutual respect between teacher educators and teachers. Teachers out in schools get to see us teaching and they get to see us teaching kids sometimes. It means schools are prepared to take on some of the theoretical approaches that have been developed here. Because they can watch you and you can watch them and they can see what you're bringing in, what you're adding".

The mentors, however, expressed views identified by Edwards and Mutton (2007), namely that partnerships are rarely complementary or collaborative when the HEI is leading the relationship. Three comments from mentors illustrate this:

> "I haven't really used [INSTEP] here. It has been mainly used for the University".

> "Most of the discussion at mentor meetings is about INSTEP and what is going to happen. But this leaves out the others. I think we should focus on the overall mentor practice and then think how INSTEP could be used to develop this".

> "They [university tutors] are telling us about the opportunities but we never wanted to be an INSTEP school, because we just had too much going on at that time to want [to] be thinking about organizing anything else".

Each participating school could have made an important contribution to the overall university-school partnership by making their expertise available, particularly through the INSTEP framework. This was never asked for. Throughout the project only 3 schools (2 in year 2 with one dropping out and being replaced by a different school in year 3) were regularly involved. The others played a minimal role or were not used whatsoever. The involvement was never focussed on their own expertise but on helping to make classroom activities available to the ITE group.

Learning to use the technology involves more than training in operating the hardware and software. It requires pedagogic understanding of what the applications are capable of delivering (Scott and Robinson, 1996). This was not the case for the INSTEP project. The multidimensional nature of change, particularly the focus upon human factors, did not feature in the development of the programme. One tutor commented,

> "What we have is a technical manual for using INSTEP and now what we need is an educational manual. The real problem of training at any level is one of time, I've always been reluctant to call teachers in after school because I don't think training should be done in their own time but schools can't release teachers as much as they would like – so we compromise and do what we can."

This 'problem' was not discussed with the key mentors, and this limited the effectiveness of the project. Nor was there any discussion amongst the project team or the mentors that might have led to developing a pedagogic understanding of what the technology and applications were capable of delivering (Scott and Robinson, 1996). The participating mentors only had technical support for the lifetime of the project; they were not asked to discuss the challenges of adopting new practices nor encouraged to share their experiences.

Militating against the effectiveness of INSTEP was the high turnover of school-based mentors associated with the project. While this factor faces all ITE partnerships, it has a greater impact when there is a novel technological project to support. Edwards and Mutton (2007) make a further point that local institutions become preoccupied with their own concerns and local learning may well be lost to future practitioners. Edwards et al. (2002) indicate that pupil performance rather than ITE is the main focus of activity for schools and while there are some highly effective university-school collaborative partnerships, the continuity and consistency of mentors cannot be assumed.

5.3.3 Coaching

I believe that a major opportunity missed throughout the period of the project was that of recording the lessons of the trainee science teachers. Recordings could have been used to support the trainee teachers by giving focus to teaching episodes in which they were involved (Newton & Sorensen, 2010). The trainees were able to reflect on the experience of

others, albeit mainly experienced teachers, but without the immediacy of personalised coaching related to their own experience.

Although the recording of lessons was the widespread desire of both trainees and mentors in INSTEP equipped schools, technological issues were reported that militated against it. The mentor steering group at the beginning of the project was led to believe that the technological difficulties would be resolved in the short term[30]. The work reported by Coyle (2004), regarding the University of Nottingham Teaching and Learning Observatory, and the concurrent work at the University of Southampton (Dyke et al., 2006) suggested that these difficulties were not insurmountable. However, the pursuit of such solutions was restricted by the lead tutor who expressed the view that he didn't want lessons to be recorded as they soon ossify and that having a live feed with no recording avoids difficulties with data protection[31]. While this viewpoint was known and at odds with the mentor steering group, it was not known that these priorities had already been internally set.

A number of studies (Sherin and Han, 2004; Towers, 2007; Pea et al., 2006) indicate the value of recording lessons for developing the ability of trainee teachers to reflect and analyse their practice. Borko et al. (2008) argue that a video recording of a lesson can support collaborative learning focussed on reflection, analysis and consideration of alternative pedagogical practices. These have been discussed earlier and suggest that this aspect of the project could have been developed further.

5.3.4 Practical Work in Science

Practical work is a distinctive aspect of science teaching (Wellington and Ireson, 2008), so much so that Henry (1975) argued that it was something of a heresy to question the importance of laboratory work in science courses. This perspective continues to this day. Bell (2008) argues that practical work is at the heart of science teaching and the carrying out of experiments and investigations is a highlight of pupils' experience. Although many authors discuss the nature and value of practical work, Nott and Wellington (1997), Jenkins

[30] Source: Notes and minutes of the mentor steering meetings throughout the project.
[31] The Lead Science Tutor expressed this at a seminar where I was presenting some of the findings of the evaluation (University of Brighton – 25th November 2008).

(1998), Woolnough and Allsop (1985), Watson, (2000), Wellington and Ireson (2008) are among the very few who discuss the pedagogies involved in undertaking practical work in school science. INSTEP could have contributed to this by offering the potential for trainee teachers to observe and subsequently reflect on a range of practical work activities carried out by different experienced science teachers (Wellington and Ireson, 2008).

How best it should be organised, and for what purposes it might be used, requires careful consideration and planning. Wellington and Ireson (2008) identify six possibilities for organising and carrying out practical work in schools. Each type has its own pedagogy and practice. The potential for using INSTEP technology to illustrate good practice in undertaking these different types of practical work cannot be underestimated. Whether by contextualisation or decontextualisation, the principles and practices could have been considered by the science trainee body thus preparing beginning science teachers for future experiences in schools.

Within the PGCE Science tutor team were views that ranged from practical work being required every lesson to only when it illustrates scientific theory. This debate is not new and can be traced back to the early 1980s (Johnstone and Wham, 1982, Moore and Thomas, 1983). The tragedy in this case is that the differences in opinions amongst the tutor team led to inaction, and the pedagogies involved with undertaking practical work were not being considered. Thus the trainees missed out on valuable insights into a major aspect of their practice.

5.3.5 Continuing Professional Development

The potential benefits for Continuing Professional Development (CPD) were raised by each of the university tutors. As one commented,

> "CPD is an area where INSTEP can have a big impact. The old model of teachers leaving their school after a long teaching day, leaving their school to listen to someone tell them about an innovation in teaching – it's not attractive to teachers. We can take schools with particular expertise and we can show science teachers in a large number of schools how that is being delivered in real time".

This was predicated on the view that the INSTEP equipped schools would be satellite hubs for neighbouring partnership schools.

The pre-ITE subject knowledge booster sessions were undertaken during year 2 in the INSTEP equipped rooms at the university. The aim was to enable access to be viewed in partner schools; but this was never advertised, nor did any teachers view these sessions.

5.4 A Personal Insider Perspective

Part of the complexity in undertaking this research arose from my position in the research. At one level I was the internal evaluator working in parallel with an external team, while at another level I was undertaking insider research. My view at the end of Year 1 (when I was invited to undertake the internal evaluation from the October of Year 2 to the end) was that working in parallel with the external evaluators would be more difficult to negotiate than my own insider position. I was concerned that the external team would be driven by an agenda specified by the sponsors that might compromise work I wanted to undertake for this thesis. Naively, I believed that my long standing work and friendship with the university tutor team would facilitate the research. Both assumptions were wrong.

The strong working relationship between myself, as internal evaluator, and the external evaluators was established at a joint meeting in January 2006 (Year 2). At this meeting both a joint evaluation plan and working protocols were developed. These included:

1. There would be regular joint reviews of the progress of the evaluation undertaken through face to face meetings, telephone conversations and e-mail correspondence;

2. Both teams would act as ‘critical friends’ by providing formative and summative feedback to the project leadership;

3. The work of the teams should be both complementary and collaborative, with the role of lead evaluator being split between the two teams on different aspects of the evaluation;

4. The two teams would (a) share all raw data in order to enhance capacity, (b) maximise opportunities for data generation, (c) avoid duplication where possible and, more importantly, (4) minimise burdens on research participants. The external evaluators had already undertaken the pre-INSTEP interviews. I designed and implemented the questionnaire. The two teams worked together on design issues and instrument development for year 3 and agreed the division of labour.

Establishing a protocol for working and having regular communication was important in developing, what I would view, as a productive working relationship. The external evaluators had intended to share their findings through a conference presentation and subsequent publication of a paper. Due to a large degree of congruence in our findings I was invited to both participate in the conference presentation[32] and co-author the paper (Mitchell et al, 2010). Further analysis of the data offered the opportunity of a joint second conference[33] and paper (Marsh et al, 2010).

The insider researcher position was much more problematic. Hockey (1993) suggests that the roles of researcher and subject are less clearly defined when friends are involved. Ashforth et al., (2000) write about the confusion, anxiety and embarrassment that can arise when role boundaries are not segmented and thus roles are blurred. In this context the there was some blurring of my role as long time friend, mentor, partner in other collaborative activities and evaluator. My friendship, particularly with the lead tutor, resulted in:

1. Delaying asking searching and critical questions of the project leadership. Drake and Heath (2008) recognise the potential for compromise of research by being reluctant to challenge the views of people they've known for some time;
2. Disappointment in not being able to have the tutor team articulate their objectives for the internal evaluation;
3. Dismay at the restricted secondary access (Brannick and Coghlan, 2007), particularly with documentation.

[32] British Educational Research Association (BERA) conference in Edinburgh, September 2008
[33] Computer Assisted Learning (CAL) conference in Brighton, April 2009

I had resolved this problem by the beginning of my second year of the evaluation (i.e. Year 3 of the project) by reflexively addressing three key issues. First I decided my own objectives for the evaluation by using my knowledge of the tutor / mentor / trainee community and my hopes for the project. Second, there was a natural distancing from the tutor team in year 3 when I got promotion to another school that was not in the project. The third involved triangulation with the external evaluators. Thus I felt able to progress the evaluation.

This issue of the identity of an insider researcher, and the way respondents react to it, is discussed by Preston-Shoot (2009), who focused on problems associated with multiple identities and role duality. My perception was that I was viewed, particularly by the university tutor team, as an experienced mentor who was undertaking a professional doctorate. Although they responded to requests for interviews, I was not treated as an evaluator until the tutor team saw the final report of the external evaluators, in which they felt they had been unfairly criticised. It seemed that for them the internal evaluation was an unwanted appendage: key documents were not disclosed until after the external evaluator's final report; and my formative feedback was given nodding ascent in meetings, but then ignored. As Edwards (1999) points out the change in role may mean the insider researcher is no longer privy to the kind of information previously enjoyed. The mentors, however, were more forthcoming than the tutor team. "Subjects are less likely to conceal information from their like" (Hockey (1993, p204).

Access to documentation after the publication of the external evaluator's report was provided with the request that I, as "their evaluator" challenge the findings of the external team. Having had access to all the raw data I judged that the external evaluators' report was fair and responsive to the criteria upon which the external evaluation was based. Moreover, I had been invited to review their report before it was made available to the tutor team. The documentation, however, confirmed a number of suspicions that I held about the direction of the project and served to uphold the external evaluation report. The tutor team were negative when I reviewed this report with them.

Preston-Shoot (2009) also discussed potential ethical issues such as the balance between the demands for good news and taking an opportunity to be critical. My experience was that

any criticism was excused or deflected, either in terms of 'they would say that' or because there were problems with the technology. In this sense it appears to be either a denial or 'watering down' aspects of practice (Darra, 2008) or what Eraut (2004c) describes as deceptive discourse. Difficulties can occur, not necessarily consciously, when participants fear that they might be exposed or put at risk (Smyth & Holian, 2008). I was surprised at the intensity of the negative reaction of the tutor team to the external evaluators' report[34] and the subsequent dismissal of most of my findings.

A second issue centres on when stories or comments can and cannot be told. At the heart of this is the demonstration of trust and care of relationships. I was spoken to 'in confidence' by both mentors and tutors and one cannot 'un-hear' comments made on social occasions, e.g. on a train journey or at a barbeque. This is a consequence of privileged access (Drake and Heath, 2008) that adds to my knowledge as a researcher. I had to carefully filter these in order to avoid bias. Mercer (2006) discusses the use of 'incidental data'. I chose not to use material from such informal conversations as the collection of this data had not been negotiated.

Insider researchers are caught between issues of loyalty, behavioural claims and dilemmas of identifying real effects (Brannik and Coghlan, 2007). They have to manage the organisation's politics; and this was a very difficult task. Drake and Heath (2008) write:

> "people's behaviour is driven by political stratagem and so the research can never be 'clean', 'neutral', 'objective' (p141)

The political agendas had, in my view, an important impact on the evaluation of the project. Such agendas included:

1. The influence of stakeholder interests – the greatest influence was located with the university tutors and reflected the balance of power between the mentors and the tutors. The impact was seen in the seemingly lack of influence the mentors had in the project and the subsequent disengagement of some mentors from the project.

[34] To my knowledge there has been no sighting or discussion of this report by the mentors, so their reaction is unknown.

The third major stakeholder group, the trainee teachers, had no influence whatsoever.

2. Control – in particular messages and access. Throughout the lifetime of the project the potential of INSTEP was talked up (Darra, 2008) yet a number of the original aims were unfulfilled. My restricted access to project documentation until the conclusion of the project militated against providing the quality feedback I would have liked to have provided.

3. Focus and priorities – it was only after the project had concluded was it revealed that the recording of lessons was not desired or pursued by the lead tutor (see p124). The focus and priorities had been set regardless of the discussion and desire of both mentors and trainees.

These were not always apparent particularly in years 1 and 2 of the project and may well reflect my closeness to the tutor team and my involvement as participating mentor in a partner school. I had been a mentor for over 15 years and for 10 of those I was on the mentor steering committee. Even with this experience, I was never sure about whether underlying agendas were being enacted or not. I had much greater clarity after the project had concluded at the beginning of year 4 and I was given access to previously undisclosed documentation.

Coghlan and Brannick (2005) suggest using force field analysis to assess the potential impact of political agendas. However this is contingent on being able to realistically estimate the effect of individual forces. My experience is that this is difficult to do when there is a lack of congruence between theories-in-action and espoused theories (Argyris and Schön, 1996) yet the espoused theory suggested a closing of that gap.

Chapter 6 – Conclusion

This evaluation has identified a number of important issues:

1. InSTEP has played a role in enhancing the development of trainee science teachers;
2. There was unfulfilled potential, e.g. in developing opportunities to strengthen the ITE partnership and give wider provision of Science Education through InSTEP (e.g. CPD);
3. Undertaking the research has been complicated by the complexity of inter-personal relationships thus leading to some insights into the discourse of insider research.

6.1 Enhancing the Development of Trainee Teachers

INSTEP played a role in bridging the gap between theory and practice and the professional learning of these trainee science teachers. INSTEP sessions seemed to achieve this by:

1. bringing a greater range of classroom practice into university-based teacher education settings thus enabling the trainees to observe a wider and more diverse range of practice than they would otherwise do so.
2. setting that practice in a context in which student teachers could interact and draw on the experience of university tutors and school practitioners, sometimes during real time observation. The tutor mediated observations facilitated the development of ideas and the linking of observed practice to a theoretical framework;
3. setting that practice in a context whereby reflection and peer discussion occured;
4. stimulating discussion between student teachers and their peers on the basis of shared common experiences of classroom activity.

During INSTEP sessions, as suggested earlier, classroom observation and theoretical ideas were linked in an immediate way. This stimulated and facilitated guided reflection and discussion between trainee teachers and their peers on the basis of a common and shared classroom observation. While the impact of video as a tool for enhancing student teachers'

reflective and analytical ability has been widely reported for some time (Copeland and Decker, 1996, Whitehead and Fitzgerald, 2007), new evidence suggests that peer interaction may also be important in scaffolding the reflective process (Harford and MacRuaire, 2008). This process is clearly not unique to INSTEP-style teacher education, in that it could equally be said to be an intended outcome of many traditional teacher education activities, but INSTEP does extend opportunities for this synthesis to take place.

One value of INSTEP might lie in its capacity to bring the practical learning of the school classroom into the university setting. The trainee science teachers involved with INSTEP had the benefit of expert commentaries from university tutors and the opportunity to explore their experience in discussion with other trainees. In this way trainees are empowered to recognise, analyse and evaluate good practice (Perry and Talley, 2001). The consensus from the participants in this study was that INSTEP contributed to the development of the professional learning of the trainee teachers.

As Smagorinsky et al. (2003) and Eraut (2004) amongst others have indicated, there are features of the way educational theory is addressed in 'traditional' teacher education settings that make it resistant to transfer into the domain of practical activity in schools. Amongst these is the abstract or uncontextualised nature of theoretical concepts which present difficulties for the teacher educator attempting to provide illustrations or examples of such concepts for student teachers with little recent familiarity with schools. A second element which problematises the transfer of knowledge between the settings is the situated nature of learning (Brown et al 1989). The association by student teachers of theory with the university classroom and practice with the school classroom can be seen in terms of the divergence of two communities of practice (Wenger 1999, Smagorinsky et al 2003) and, to an extent, mirrors the physical separation experienced by the two sets of practitioners. University tutors rarely find themselves in schools for purposes other than observing student teachers, and most school practitioners generally have limited awareness of, or involvement in, university-based teacher preparation activities.

INSTEP and similar technologies have the potential to mitigate both these barriers to knowledge transfer between the school and the university setting. By drawing on live classroom activity, the INSTEP technology created opportunities for assisting student teachers to develop an understanding of the relationship between theory and practice at an early stage of their ITE course. It seems that part of the value of such INSTEP sessions might lie in their capacity to loosen the association of theoretical learning with the teacher education classroom and practical learning with the school classroom, thereby providing a catalyst for knowledge transfer between these settings.

One of the many questions that arose in the course of this evaluation was the relative advantages of the synchronous and asynchronous observation of classrooms. As discussed above, Dyke et al (2008) advocate the benefits of synchronous observation which can allow the observer to select what he or she sees by remotely moving cameras and/or manipulating images. They suggest that this element of control emulates the capacity of an *in loco* observer to refine their interpretation of events through selective observation. They also argue that there are practical benefits in terms of time efficiency and in the immediacy with which feedback on the observation can be exchanged. The evidence from this evaluation would suggest that there seems to be a value in tutors and student teachers sharing and discussing a common contemporaneous experience. The classroom activity observed by student teachers through the INSTEP system was perceived by student teachers as being authentic and therefore carried more credibility than representations of practice in 'staged' video recordings.

Equally, it appears that asynchronous communication offers additional possibilities for teacher education which INSTEP, with its exclusive reliance on synchronous communication, did not offer. For example, INSTEP did not allow for the recording of video data, with the consequence that student teachers were unable to observe recordings of themselves, in spite of a widespread wish amongst student teachers and mentors for this to take place. As a result, INSTEP seemed only to have offered student teachers the opportunity to reflect on the experiences of others without the immediacy of personalised coaching. There are obvious benefits for student teachers to be derived from the

observation and critical review of their own practice in this way, especially with the assistance of a mentor or other teacher educator (Borko et al. 2008). Student teacher reflection may also be supported, as Rich and Hannafin (2009) describe, through the use of a variety of software packages which can be used to manipulate and annotate recorded video.

It therefore seems that both synchronous and asynchronous interactive video have their contributions to make to teacher education. Indeed, the distinction between the two modes is not perhaps as clear as the above discussion suggests. For example, the same sort of image control associated with synchronous feeds might also be achieved in asynchronous applications where the user could choose from a set of separate video data feeds. Equally, recorded classroom activity could be experienced 'as live' by student teachers during sessions in the teacher education classroom. Moreover the quality of the personal interaction within interactive video sessions appeared to be important for realising the potential of INSTEP. Those tutors observed demonstrating their skills to contextualise and decontextualise examples of theory and practice, happened to be working with a synchronous feed from the classroom; but those interactions would have been experienced by the student teachers involved in much the same way perhaps, had they been observing and interacting with recorded video data.

The clear consensus from participants in this study was that INSTEP contributed to the development of classroom observation skills in student teachers. This was particularly beneficial in the early part of their ITE training. These gains in the ability to observe are comparable to those reported by Sherin & Van Es (2005) in similar circumstances. Student teachers involved with INSTEP had the additional benefit of expert commentaries from university tutors and had the opportunity to explore their experience in discussions with peers and with school practitioners during 'live' INSTEP sessions. INSTEP therefore seems to support a highly favourable environment in which to develop observational skills and there is evidence of the impact of the technology in this respect.

The data also points to other benefits for the trainee teachers. An opportunity for the tacit knowledge of observed teachers to be made explicit arises when there is a tutor mediated commentary along with the discussion of an observed lesson. Thus insight into practice is gained and the gap between theory and practice is shortened. This occurred in a collaborative setting and is consistent with what Holmes et al., (2001) describe as communal constructivism. This reasoning about practice, scaffolded by the tutors, is the beginning of reflective practice. Additionally these sessions afforded the trainees an introduction into the language of pedagogy, a requirement of joining the teaching community.

6.2 Unfulfilled Potential

I view the impact of INSTEP on enhancing teacher learning as being of importance and the major positive outcome of the project. However, the leadership of the project by the tutors with their primary focus of using INSTEP to support their teaching in the university resulted in opportunities being missed and some of the original project aims not being fulfilled.

6.2.1 Infrastructure Issues

A continual challenge throughout the lifetime of the project was the efficacy of the technology. It promised so much yet was limited in delivery. Development of the software was significantly behind schedule right from the start of the project. It was distributed before being fully tested and so functionality was problematic, particularly in years 1 and 2. While there was a technical manual, there was no corresponding pedagogic manual; and this resulted in ambiguity and frustration.

Borko et al. (2009) highlight the constraints on a project brought about by new technologies. They are characteristically unstable, somewhat unreliable and are often updated. While they can support novel learning experiences, to which INSTEP can make a genuine claim, new technologies add to the complexity of innovative developments. Thus Borko et al. (2009) advise wise and efficient use within the boundaries of what the

technology can deliver rather than the glitz of what might be hoped for. This lesson was not, in my view, understood by the project team.

6.2.2 Direction of the Project

There appears to be considerable scope through INSTEP-type applications to enhance collaborative working between schools and universities, co-ordinating and resituating elements of learning by student teachers and, in the process, contributing to the development of both university tutors and school-based practitioners.

The minutes of the mentor steering group point to the university tutor team placing an emphasis on (1) the use of INSTEP primarily to service their teaching sessions, (2) publicity to draw in further funding and (3) highlighting an almost utopian future for the project. This extolling the merits of the technology (Scott and Robinson, 1996) was a dominant feature. Even with a focus on supporting the tutors' teaching sessions, there is some evidence of the technology being used in a haphazard and unplanned way, simply because it was available. This appeared at times to take priority over individual trainee development. As one trainee put it, "Sometimes I think they were just showing off."

This contrasts with the vision of the mentors who, at the beginning of the project, articulated the potential for recording trainee teachers and thus shaping their mentoring role. The trainee teachers only had opportunity to reflect on the experiences of others without the immediacy of personalised coaching. The use of 'down-time[35]' when the technology could be used to support the professional development of colleagues in school was also discussed.

An important message from the evaluation was the lack of shared ownership of the project. The evidence is that:

[35] Down-time was that period when the INSTEP technology was not being used for the purpose of initial teacher education

1. the mentors were not fully engaged with the project. They were not empowered, rather they were, to an extent, controlled (Brown and Rutherford, 1998);
2. there were important differences in understanding between the university tutors and the mentors as to the strength of the partnership and the value of the project.

Crucial to developing practice is the notion of decision making being based on the moral authority that is derived from shared professional and social values. This promotes social cohesion and collegiality. Busher (2005) suggests that this approach to decision making is facilitated by the values arising from distributed leadership. On the positive side this fosters trust and develops shared values, and participants are likely to sustain a constructive dialogue about teaching, learning and the development of students. This, he notes, translates into changes in practice. He does, however, warn about those who project a forceful personality whatever their position. Such people may be coercive and effectively produce non-consultative leadership. Thus Busher (2005) writes about the notion that leaders use power in a variety of ways to shape the work of colleagues; there is differential access to power. Thus interactions are not value-free activities and can lead to the leader being perceived as a bully or autocrat or diplomat or marketing manager. With regard to InSTEP there was a single, albeit valuable, focus set by the tutor team to which the mentors had no power to shape or add.

Thus one outcome of the INSTEP project is to question the notion of partnership. There is certainly a commitment on behalf of the mentors to support ITE but the extent of genuine partnership is another matter.

6.3 Some Insights on Insider Research

Throughout this thesis I have discussed issues arising from researching from the inside of the project[36]. However I believe there are features of this research that contribute to further understanding of the insider research discourse. These include:

[36] See particularly sections 3.4.3 (p74ff), 5.4 (p124ff) and 7.2 (p140ff)

1. The nature of the organisation – a number of researchers describe the impact of undertaking their research within their own organisation. In doing so they offer insights into working with colleagues at different levels of the organisation. INSTEP, however, spanned the partnership relationship between the university and schools – different communities with their own set of priorities. Thus my 'insiderness' was located in the network of relationships between both groups.

2. Ownership of the project being researched – much insider research involves the researcher directing the project. For INSTEP I was involved in the project but the project was led and directed by the university tutors. While I was able to engage with cycles of reflection and action (Coghlan and Brannick, 2005) this was not the case for the university tutors. Like Humphrey (2007) I noticed a lack of enthusiasm for my evaluation.

This added to the complexity of the evaluation. Sikes and Potts (2008b) indicate that insider researchers should have clarity about their research undertaking. While it is possible to delineate pre-understanding (Coghlan and Brannick, 2005) and give consideration both to organisational and researcher roles, the challenges of the above features result in greater complexity and uncertainty than might be anticipated. This manifested itself in:

1. Role duality – both in how I perceived myself and how others perceived my role. I've already commented about the way I believe my role was perceived. What was not so clear were my own perceptions. At the beginning of Year 2 I certainly acted more as a mentor than evaluator; this reflecting both the development of the project and the very early stages of my research. As time progressed the balance changed. As Ashforth et al., (2000) note transitioning roles can produce confusion and anxiety.
2. Access – having insiderness located within a network of relationships rather than within a specific organisation requires a lot of trust in order to gain access to all documentation. There was documentation about the progress of the project held by

the tutor team which neither the mentors nor evaluators knew existed until the end of the project.

3. Politics – throughout the lifetime of the project there was the continuous influence of micro-political issues within the university, within each partnership school and between the university and the partner schools. Moreover there was the asymmetric relationship in the university-school partnership and issues of where the balance of power lay. Both evaluation teams had to steer their way through these.
4. The ability to use the evaluation data to inform the development of the project – as the project was led by the university tutors, the impact of any formative feedback that might shape the future direction of the project was contingent on the receptiveness of the tutors to receive and act upon it.

A reflexive response helped me navigate through some of these issues. Working in a different school during year 3 created some distance from the setting (Coghlan and Holihan, 2007) that enabled:

1. A more critical view of my own identity. I was no longer a mentor even though I attended all the mentor and mentor steering meetings.
2. Decisions to be made about the research questions and the purpose of the evaluation in the absence of guidance from the tutors. Humphrey (2007) writes of the dangers of being too close to the setting and consequent impact on the effectiveness of the research. Being a participant mentor in year 2 led to vested interests in the development of the project that inhibited clarity of reflection and analysis.

Chapter 7 – Learning from the Evaluation

There are two core issues arising from this research to which I wish to draw attention:

1. the use of innovative technology to support initial teacher education;
2. the nature of insider research as it has impacted this thesis.

7.1 The Use of This Innovative Technology to Support ITE

The use of INSTEP technology makes possible the presentation of complex classroom interactions that are hard to match when simply undertaking an oral presentation. The use of interactive video technology brings to life everyday classroom experience in a way that is not otherwise possible. This technology has enabled the trainee teachers to observe classroom interactions as they occur. These observations have been undertaken in a group setting and mediated by an experienced tutor. There have been examples of good practice which have been modelled to the trainee teachers.

Nevertheless, there are key lessons which can be learned from the INSTEP project. The project made the greatest impact when:

1. There was appropriate planning of each session with specific learning objectives in mind. This includes the preparation of the trainee teachers as well as effective liaison with the partner school and teacher concerned. Where there was focus, the teaching sessions were successful in enhancing trainee learning. INSTEP sessions were perceived as less successful when planning was not at the forefront, lesson plans were not available and there was a sense of 'dropping in' to what was happening in the partner schools.
2. Thought was given to the timespan of each observation. Long periods of observation resulted in parts of the lesson not being used. This links closely to

planning. The greatest impact was when specific episodes in lessons were targetted with specific learning objectives in the minds of the tutors.

3. There was communal constructivism whereby the tutors and trainees together discussed, analysed and deconstructed observed classroom practice resulting in structured collaborative learning.
4. There was appropriate tutor expertise in interpreting and commentating upon what had been observed, so that the learners' use of the video was scaffolded. Successful trainee learning occurred when the tutors effectively integrated a theoretical perspective with the observed classroom practice.

The data points to how video technology supported the link between theory and practice for beginning teachers, and enhanced and accelerated the growth of beginning teachers' professional knowledge through enabling reflective practice, facilitating collaborative learning and supporting the development of the language of pedagogy.

However, it is also important to learn from those aspects of the project that did not go well. This was a complex project with enormous potential; and its failure at the beginning of the project to consult the body of literature that pointed to both the potential and affordances of INSTEP type projects, seriously limited its effectiveness. There was an evolving discourse of what would or would not work; but this lack of engagement with the literature led to several aspects of the project being ignored.

The relationship between research and development is important. Although INSTEP was primarily established as a development project, some important features were missing:

1. An understanding of the discourse surrounding video technology that might otherwise have enhanced the effectiveness and direction of the project;
2. The research itself - although it was a development project this was sited in a university with real opportunities for research that were relevant to the purpose of the project.

INSTEP had a high profile both within the university and beyond. Consequently it required structures that facilitated effective leadership and accountability. The university steering group should have been in a good position to undertake this role; but the membership and expertise from outside education were mainly from administrators rather than IT experts; and the recorded apologies for absence hint at a lack of consistency in the group membership that limited the group's effectiveness (e.g. no-one oversaw the technical development of the project) and provided greater opportunity for control by the tutors. The outcome was an emphasis on the dissemination of information rather than strategic leadership, thus reinforcing the location of control and ownership within the tutor team. Examples of this were the carefully framed showcase events. It was these events that were observed by the steering group and invited outside parties rather than the day to day working of the project.

There were problems with technical capability right from the outset. The tutor team ought to have clarified the real position of the technical capability. A second issue that should have been learned from the project was the importance of engaging with all the stakeholders. The level of engagement with the mentors was when no project was being implemented and far too low for a crucial development. Significant opportunities for using their expertise were needed, but unused; and many mentors would have been interested in further professional development using the INSTEP technology. Another issue was that of collegial developments: the three year project had only one primary dimension, servicing the teaching of the ITE tutors at the University.

7.2 Lessons from Being an Insider Researcher

Sikes and Potts (2008a) offer a useful framework for reflecting upon experiences of insider research. This is:

1. entering the field;
2. being in the field;
3. leaving the field;

4. writing;
5. dissemination of the results (p8).

Entering the field was a relatively straightforward. It came as a request from the tutor team to consider whether I would undertake the internal evaluation and use it for my doctoral thesis. Without being too speculative I have since wondered whether friendship and convenience were the motivating factors. For my part, the opportunity to have further involvement in what I believe to be significant project was attractive.

The difficulties arose from being in the field and undertaking the research. Sikes and Potts (2008b) suggest that insider researchers should be clear about what they are undertaking. My experience is that having read and considered insider research (see section 3.4.3) one cannot necessarily predict the idiosyncratic actions of individuals. There appeared to be a reluctance to engage in reflection and discussion of the direction of the project that I had not anticipated, even after having known and worked with the lead tutor over many years. I had expected to benefit from (1) my prior knowledge of the PGCE course (2) insights gained from knowing many of the stakeholders, (3) having access and (4) general familiarity (Wellington, 1996 and Hockey, 1993). What I had not anticipated were the practical tensions that arose from:

1. Role and identity duality – I had a genuine desire to see the project succeed and had hoped to provide supportive formative feedback as an evaluator. However, I believe I was viewed by the tutor team only as a mentor, even when I moved to another school and was not fulfilling that role. It was also important that I understood the flexibility of my roles. At times I could be in a meeting undertaking an organisational role, e.g. being a mentor, yet at the same time I would be seeking information for my role as evaluator. Coghlan and Brannick (2005) also discuss the different rearch perspectives that an 'insider' brings. In this context the evaluation research was:

    a) For my own personal and professional development;

b) Working on a practical issue for the PGCE Science community in terms of supporting the development of INSTEP;
c) Generating understanding and theory that could benefit others.

2. Access – throughout the project I had a sense of things not being what they should be. These suspicions surrounded the capability of the technology to deliver what was promised and the overall direction of the project. With no documentary evidence available to support this, it was difficult to give full and effective formative feedback during the lifetime of the project. However, on seeing the documentation after the external evaluator's report, my suspicions were confirmed. Unfortunately this coincided with the termination of the project and thus had no further influence. Effective formative evaluation is contingent on (a) having sufficient access to data and (b) the participants being receptive to and prepared to engage with the feedback. Neither of these were in place. Throughout the lifetime of the project the flow of information was controlled by the tutor team and my feedback at the mentor steering group was ignored. Thus the formative function of this evaluation was greatly restricted. Coghlan and Brannick (2005) note the importance of negotiating the degree of access at the outset of the research. In the context of this evaluation I was unable to have the tutor team articulate what they desired from the project thus negotiating access was never discussed.
3. Power relationships – the power to shape the project was centred solely within the tutor team. One effect of this was the disengagement of some mentors. Coghlan and Casey (2001) indicate that the key to success lies in assessing the power and interests of the relevant stakeholders in relation to aspects of the project. In Years 1 and 2 of the project the locus of power was understood but the dynamics were well disguised. Success was difficult to achieve thereafter.

Drake and Heath (2008) write of the difficulties arising from researching friends. This became more exacerbated as I became convinced that the project was being limited to only one dimension.

Leaving the field, i.e. concluding the research, was surrounded by mixed feelings. Being no longer involved with the PGCE Science programme I no longer had to negotiate issues surrounding continuing to work on the same programme with those being researched. Nevertheless there is a feeling of disappointment and dismay that the project was developed in a manner that seemed to disregard the input of the mentor body. The tutor team avoided developments they did not wish to engage with, even those requested by the mentors where the effort appeared to be minimal. It is questionable whether any structures would have countered this practice.

Writing and dissemination also produced mixed feelings. The two papers published by the evaluators (Mitchell et al, 2010 and Marsh et al, 2010) were able to demonstrate some of the gains brought through INSTEP; but disseminating the findings to the tutor team was a negative experience. I was thanked but then ignored. Much more difficult, however, has been my reflection on insider research, as it has raised questions about the performance of a long-standing friend.

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Appendix 1 – The Programme of INSTEP Activities

Year 1	Sept 2004 – July 2005	• Gatsby Funding Commenced • Construction of university steering group • Commencement of the technological development (winter and summer term) • Selected partner schools invited to bid to become part of the project • Science mentor group briefed about the project (late summer term) • External evaluators appointed
Year 2 (only 2 of the 6 schools connected)	September – October 2005	Live Trials of the INSTEP Technology (first live session on 30th Sept) with the purpose of enhancing and enriching PGCE training in Science including: a) Safety Issues in Science b) Classroom Management c) Year 6-7 Transition d) Special Needs and Science e) Assessment for Learning Due to the emerging nature of the INSTEP technology there was, at this stage, only one way communication and in these cases it was used from the school to the university.

	February 2006	Post-16 workshops in Biology and Chemistry – joint sessions with sixth form students in 2 partner schools using the INSTEP technology to link both school and university.
	March 2006	INSTEP Showcase – team teaching and curriculum enrichment – coinciding with the official launch of the project
Year 2 (continued)	May 2006	Remote lesson observation at the university by the curriculum tutor (science) and external examiner followed by feedback to two trainees who had team taught in an INSTEP technology equipped school
		Mentor meeting with trainees focussing upon lesson observation feedback and the setting of developmental targets
Year 3 (all 6 schools connected)	September 2006	Introductory PGCE Seminars using the INSTEP technology. These were: • Lesson observation • Lesson planning and subsequent INSTEP observed delivery
	October – November 2006	PGCE Programmed Workshops viewing lessons from partner schools: • Behaviour management in the laboratory • Science at Key Stage 4 (including aspects of "How science Works"

		• Bringing "awe and wonder" into Science • Assessment for Learning • Using teaching assistants to work with pupils with special educational needs in science • Literacy in Science • Citizenship in Science
Year 3 (continued)	February 2007	Workshops using the INSTEP technology for PGCE trainees during the inter-placement period were: • ICT in Science • Post-16 workshops in Biology and Physics – joint sessions with sixth form students in partner schools • Badger levelling activities – assessment at Key Stage 3
	March 2007	Two days of a pre-ITE "Taster Course" involving observation of teaching sessions in INSTEP schools.
	May 2007	Remote joint lesson observation followed by feedback of two trainees by the curriculum tutor (science) and external examiner
Year 4	October 2007	Funding ends and the project ceases activity

Appendix 2 – Background of the Trainee Teachers in year 2

The first degree undertaken by the trainees was

- Biology or Biology related first degree – 21 trainees of whom 7 took the Chemistry enhancement programme prior to the PGCE programme;
- Chemistry or Chemistry related first degree – 6 trainees of whom 2 took the Chemistry enhancement programme prior to PGCE. This is unusual but one was 9 years and the other 19 years after gaining their first degree and they wanted to update their knowledge;
- Physics or Physics related first degree – 2 trainees, neither of whom took the Chemistry enhancement programme.

Of the 9 trainees who undertook the Chemistry enhancement programme, 2 were two years after their first degree, and the other 7 were four or more years away.

Figure 1 shows that 65.5% of this cohort commenced their PGCE programme within three years of completing their first degree; and the numbers become smaller as the time gap increased.

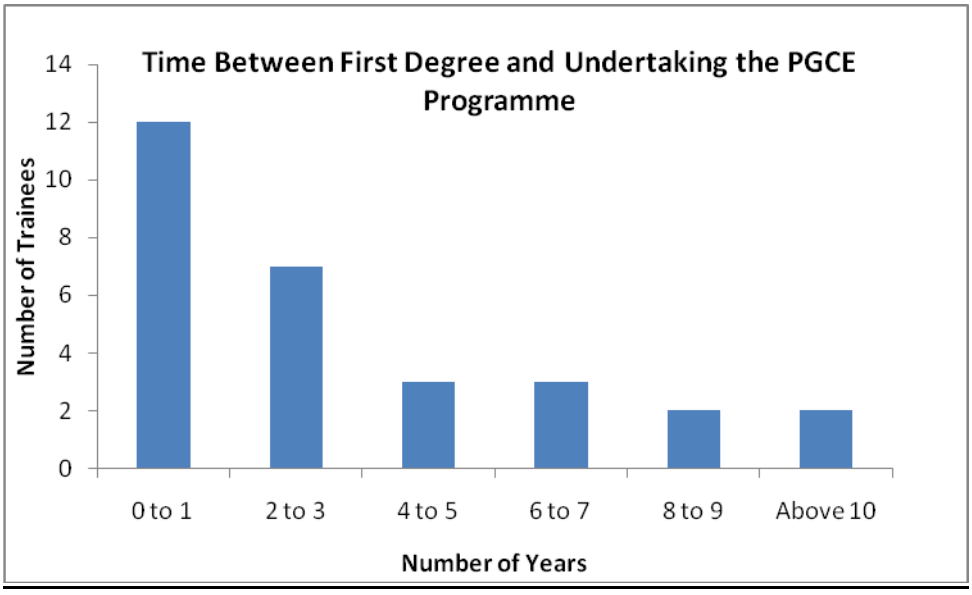

Figure 4.1: Time from First Degree to PGCE (cohort 1)

Appendix 3 – Trainee Questionnaire (June 2006)

Please complete this questionnaire. Any additional comments you wish to make will be welcomed.

Section 1 Please answer the following questions:

1. What is your gender?……
2. What was your degree subject?……
3. How many years was it between the completion of your degree programme (including post-graduate degrees) and the start of the PGCE programme?……
4. Did you undertake the Chemistry Enhancement course?……

5. How do you rate your 1st school placement? Successful 1 2 3 4 5 6 Unsuccessful
6. How do you rate your 2nd school placement? Successful 1 2 3 4 5 6 Unsuccessful
7. How would you grade your teaching? Very Good Satisfactory Unsatisfactory

Section 2 As a member of the PGCE Science Group, did you:

8. Observe lessons in schools using the INSTEP Project link? …….....
9. Ask questions to those school students you viewed on the screen? …….....
10. Make a presentation to school students using the INSTEP Project link? ……

As a trainee in a Placement School:

11. Did you observe teaching remotely from outside of the classroom? ……
12. Were you observed by teachers remotely from outside of the classroom? ……..
13. Were you observed by fellow trainees at the University? ……

Section 3

You are asked to rate aspects of the impact of the INSTEP Project on your own training.

Please rate the impact of the INSTEP Project for each of the following:

14.	Observing school lessons in real time with the help of a PGCE tutor equipped me to better observe on teaching practice	Useful 1 2 3 4 5 6	Useless
15.	Observing school lessons in real time with the help of a PGCE tutor equipped me to better plan lessons on teaching practice	Useful 1 2 3 4 5 6	Useless
16.	Observing school lessons in real time with the help of a PGCE tutor supported my development as a trainee	Useful 1 2 3 4 5 6	Useless
17.	Participating in university based showcase activities supported my development as a trainee	Useful 1 2 3 4 5 6	Useless

Section 4 You have been involved in a number of training sessions where the INSTEP Project has supported that activity. Please rate the effectiveness of the INSTEP Project for each of the following activities. If your response is 1, 2 or 3, would you please indicate how the INSTEP technology supported your training:

18.	Laboratory safety	Useful 1 2 3 4 5 6	Useless	Absent for the activity

……
……
……

19.	Classroom management	Useful 1 2 3 4 5 6	Useless	Absent for the activity

……
……
……

20. Behaviour management Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

21. Transition from KS2 to KS3 Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

22. Special Needs & Science Education Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

23. Assessment for Learning Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

24. A-level Practical Chemistry Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……....

25. DNA Presentations Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

26. Team Teaching Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

27. Science Enrichment Useful 1 2 3 4 5 6 Useless Absent for the activity

……

……

……

Section 5

28. In what ways, if any, did you personally gain from having the INSTEP Project support the PGCE programme?

……

……

……

……

29. What other activities from the PGCE programme would you have liked supported by the INSTEP Project?

……

……

……

……

30. In what other ways do you think that the INSTEP technology could support trainees on the PGCE Science programme?

……

……

……

……

31. Was the time spent on INSTEP activities well spent, or could it have been better used in other ways?

Always Sometimes Never

32. Did the presence of visitors at several INSTEP sessions affect their value?

Detract from Have no effect on Enhance their value

33. Are there any other comments you wish to make.

……

……

……

……

Thank you for completing this questionnaire.

Appendix 4 – Interview Schedule for Mentors & Trainee Teachers

Mentors

1. How long have you been mentoring?
2. Have you undertaken mentor training/CPD on mentoring?
    - P [37]What did it involve?
    - P when and from whom?
    - P How effective did you feel this was?
3. How would you describe your school's relationship with the university in relation to initial teacher preparation and CPD?
4. Are you aware of how your school come to be involved with the INSTEP project?
    - P Do you know of any form of agreement between your school and the university about how INSTEP will be used in your school?
5. Has working with INSTEP changed what you do as a mentor?
    - P Any involvement in CPD through INSTEP?
6. How have you used INSTEP with student teachers or otherwise?
    - P location,
    - P organisation of rooms,
    - P involvement of others in the department,
    - P collaboration with the university,
    - P collaboration with other schools,
    - P any recording and if so, how was it used?
    - P how effective?
7. What benefits and limitations if any have resulted from the introduction of INSTEP for yourself, trainees?
    - P In your view, has INSTEP added to trainees' preparation for TP and for teaching in general ?
        - Observation skills

[37] P represents prompts to be used if necessary

8. Are you aware that any non-teaching staff been involved with INSTEP in any way?
9. to what extent to you feel that anybody's behaviour has been affected by the presence of the INSTEP cameras.
    - Different groups trainees, university tutors, mentors
    - Examples of how – evidence?
10. Have you personally been observed through INSTEP?
    - If so, did you feel this affected your own behaviour?
11. Do you know of/use the user manual? how do they find that?
12. how often do you refer questions to the university team?
13. As far as you know, has the school made use of INSTEP other than in connection with the university?
14. Can you foresee any independent uses of INSTEP?
15. Anything you would change about the PGCE programme in general or the use of INSTEP in particular if you had the opportunity?

Trainees with 'full' access to INSTEP (group i)[38]

1. Why did you choose this university for your ITT institution?
    - Did you know about INSTEP before you chose this university?
    - Did you consider INSTEP when deciding to apply?
        i. If yes, how and why?
        ii. What did you think were potential benefits?
2. Did you have any concerns about being involved with INSTEP before the course started?
    - What were they?
    - Have those concerns been justified?
3. How have you been involved with INSTEP?

[38] Trainee teachers who were placed in one of the INSTEP equipped schools and thus potentially had access to INSTEP mediated training both in school and at the university

4. Do you feel that the behaviour of pupils in the classroom changes when you are being observed through INSTEP?
   - Do you feel that your behaviour is different when being observed through INSTEP?
   - Do you feel your mentor's behaviour is different when being observed through INSTEP?
   - How obtrusive/unobtrusive have you found the video and audio equipment?
5. Have you had the opportunity to see yourself recorded
   - If so how and with whom? (detail)
   - Would you have liked to?
6. Do you think your mentor has benefited from INSTEP?
7. Have you felt able to choose how or whether you participate in INSTEP sessions?
8. What if anything would you say are the benefits and limitations for you of having INSTEP as part of your PGCE course?
9. How do you feel your colleagues on the Science programme have felt about and dealt with INSTEP?
10. At this stage what do you think are the main principles or ideals you will take from your ITT course into your teaching career?
11. Could you briefly outline your career plans?
12. Anything you would change about your PGCE in general or your use of INSTEP if you had the opportunity?

Trainees with access to INSTEP at the university only (group ii)[39]

1. Why did you choose this university for your ITT institution?
   - Did you know about InSTEP before you chose this university?
   - Did you consider InSTEP when deciding to apply?
     i. If yes, how and why?

[39] Trainee teachers who were not placed in one of the INSTEP equipped schools and thus potentially only had access to INSTEP mediated training at the university

ii. What did you think were potential benefits?

2. Did you have any concerns about being involved with INSTEP before the course started?
   - P What were they?
   - P Have those concerns been justified?
3. How have you been involved with INSTEP?

	1.1. Trainee observing university teachers	1.2 trainee observing experienced teachers	Etc.
P When in the course?			
P How often?			
P How long?			
P did this contribute to your devt.? How?			
P was your mentor involved? How?			

4. would you have liked to have had a greater involvement with INSTEP?
   a. How and why
   b. Have you had the opportunity to see yourself recorded either through INSTEP or in other ways? Who was involved? How beneficial?
5. Have you felt able to choose how or whether you participate in INSTEP sessions?
6. Do you feel that the behaviour of mentors and pupils has been altered by INSTEP
7. What if anything would you say are the benefits and limitations for you of having INSTEP as part of your PGCE course?

8. How do you feel your colleagues on the Science programme have felt about and dealt with INSTEP?
9. At this stage what do you think are the main principles or ideals you will take from your ITT year into your teaching career?
10. Could you briefly outline your career plans
11. Anything you would change about your PGCE in general or your use of INSTEP if you had the opportunity?

Appendix 5 – Trainee Responses to the Use and Effectiveness of the INSTEP Technology

These tables are based upon the use of INSTEP by the university tutors in the subject study sessions at the university. There was no evidence of mentors using this technology with trainees in school.

Trainee Ratings of the use of INSTEP technology

	Useful ← → Useless					
	1	**2**	**3**	**4**	**5**	**6**
Observing school lessons in real time with the help of a PGCE tutor equipped me to better observe on teaching practice	2	4	6	1	14	2
Observing school lessons in real time with the help of a PGCE tutor equipped me to better plan lessons on teaching practice	1	5	5	2	13	3
Observing school lessons in real time with the help of a PGCE tutor supported my development as a trainee	2	5	9	3	8	2
Participating in longer university based activities supported my development as a trainee	1	6	6	6	6	1

It is important to note that the first 3 items were delivered in the period Oct-Dec during the 3 day / 2 day (first school placement / university) split before the block placement, when the technical problems with INSTEP were at their greatest

Effectiveness of using INSTEP technology for supporting their training

	Useful ⟷ Useless						Absent
	1	2	3	4	5	6	
Laboratory Safety	3	1	3	5	3	1	13
Classroom Management	2	3	5	3	8	1	7
Behaviour Management	2	2	5	6	5	1	8
KS2 to KS3 Transition	1	1	2	2	6	5	11
Special Needs	1	0	4	2	5	2	13
A-Level Practical Chemistry	4	3	0	2	3	6	14
DNA Presentations	2	5	3	3	4	1	11
Team Teaching	5	3	6	3	2	1	7
Enrichment	3	6	3	2	4	3	6

Appendix 6 – Additional Trainee Comments from the Questionnaire

In response to how the trainees felt they had personally gained from using the INSTEP technology they answered:

(a) Observing Lessons

- General observations of an experienced teacher allowed me at evaluate my own teaching.
- I benefited from observing lessons, but I feel that even remote observations can still be quite contrived. I feel that next years cohort will get more out of the project
- I find the team teaching useful especially in my second placement
- Observing teaching
- It was available for us on campus – accessibility and was relevant to PGCE
- Practise with team teaching and being filmed was useful. Some experience gained from watching other teachers but was restricted due to difficulties with technology
- Team teaching practically useful. A-Level Chemistry very good
- Presenting A-Level to a local school was great but the teething problems still need to be sorted out
- Gained by remote mentor observation allowing good feedback from multiple observers
- Ways of team teaching

(b) Challenges of the New Technology

- It was fascinating to be at the early stages of technology, which would become massive. Future cohorts will benefit better than us
- Not much, however I believe that the technology could be very useful once sound quality and general bugs are worked out
- It is too early to judge this project fairly
- Interesting technology yet much improvement needed

(c) Didn't Feel They Had Benefited

- None
- I don't feel I personally gained from INSTEP as only observed presentations
- I didn't really gain personally but I do think its got a lot of potential for future PGCEs
- Didn't gain any more than I would observing lessons at school
- No real gain this year, but I think the project has huge potential and should continue development
- None. I believe that it took up time where we should have had curriculum time
- I felt there were a lot of problems with the project & as a result many of us had a relatively negative attitude towards it. I do however feel it has great potential!
- It was interesting to get an insight into the new technology. However for me personally I feel I did not gain anything from INSTEP and if anything time was wasted

In response to the question, "What other activities from the PGCE programme would you have liked supported by the INSTEP Project?" the trainees responded:

(a) Recording of Lessons

- Opportunity to be subject to observed – possibly recorded so I could see myself teach and discuss with a mentor or tutor
- Recording of lessons to allow trainee to review own performance

(b) Further Observation of Lessons

- Observing behaviour management
- More group observation of good practice at start of course to help guide what to do when get into schools
- More observed lessons before teaching practice starts so that we know what we are looking for

- Teachers starting out with a class in September and putting forward rules
- Recording of lessons to allow trainee to review own performance
- Cross university activities. Some video from junior schools – transition. INSTEP could support INSET so trainees can watch from university to gain extra training and experience

(c) Additional Requests

- Speaking to teachers and students if the technology is up to it
- Extra curriculum activities
- Maybe do our Professional Studies presentations with INSTEP cameras rolling.

The trainees were asked, "In what other ways do you think that the INSTEP technology could support trainees on the PGCE Science programme?" Their responses were:

(a) The Desire to Have Lessons Recorded

- Opportunity to be subject to observed – possibly recorded so I could see myself teach and discuss with a mentor or tutor & observe a lesson and discuss good/bad points as a group. If this was the focus rather than trying to make it interesting
- Record their lessons so can look back on them
- Video lessons – watch own teaching. Discuss feedback with video running
- Trainees should be better equipped with skills for classroom observation, behaviour management and practical science issues prior to starting their first placement by peer review of INSTEP – observed lessons

(b) Further Observation

- Instant observation of trainees in school. Mentors record your lesson and play it back to you
- To help give them advice on how to observe a lesson when they start out
- Allowing observation of more variety in forms of schools and teachers

- Discussion of good practice etc. Watching experienced teacher in group situation to gain others thoughts
- Watching pre-recorded, edited good lessons and bad lessons, which will reduce time wastage
- Remote monitoring of all trainees teaching and feedback on their performance later in course – particularly where trainees feel they need support
- Watching experienced teachers have good and bad lessons

(c) Other Issues

- More organised in the connection as often it took a long time to connect and then we couldn't hear
- Perhaps linking with other universities so that we can discuss issues
- Links with other universities

The value of sessions using the INSTEP technology was explored. The trainees responded:

- 2 indicated INSTEP time was always well spent
- 3 indicated INSTEP time was never spent well
- 24 indicated INSTEP time was sometimes well spent
- 1 indicated visitors detracted from INSTEP sessions
- 3 indicated visitors enhanced INSTEP sessions
- 25 indicated visitors had no effect on INSTEP sessions

Finally the trainees were invited to make any other additional comments. They responded by writing:

- This is a fabulous resource. We suffered from poor sound quality. This sound quality has improved a thousand-fold since October, but once the delay issues and microphone deficiencies are sorted. INSTEP will be brilliant. Keep on developing it!
- I think it has potential but needs refining
- INSTEP has a role, but needs to be thought out as to how to gain maximum benefit

- The Project is clearly in its infancy and technical issues meant it was fairly ineffective. Videoing relevant parts of lessons could be more useful
- INSTEP was helpful and essential
- Will be great when it gets up and running well – think it will be a brilliant tool for trainees, pupils and staff alike
- Project will be good when complete, but this year I don't think it benefited me much
- Great potential for future trainees but the sound problems need to be sorted
- Great potential and will definitely enhance teaching of later years in PGCE but I didn't feel it really helped us due to all the problems
- Still believe that observing good practice is most effective. However occasionally may be good for all students to comment on one teacher as a group.

Appendix 7 – The Trainee Year

This was the same pattern for both 2005-2006 and 2006-2007

Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Induction – mix of educational studies and science subject study lectures	3 days in partner school (observing and starting teach parts of lessons) / 2 days at university – mainly science subject study lectures		Full block placement in 1st partner school – teaching up to 50% full timetable		Inter-placement period at university - science subject study lectures	Full block placement in 2nd partner school – teaching up to 60% full timetable			Final assessments