Enhancing subject-specialist pedagogy through the initial teacher education of science, engineering and technology teachers in further education colleges

Report for The Gatsby Charitable Foundation

Professor Kevin Orr, Dr Pam Hanley, Jonathan Hepworth and Dr Ron Thompson,

Huddersfield Centre of Research in Education, University of Huddersfield

Contents

Acknowledgements

The authors would like to thank Jenifer Burden, Hannah Stanwix and Natasha Watkinson of the Gatsby Charitable Foundation for their support and encouragement throughout the duration of this project. We would also like to thank all the practitioners who participated in the intervention and who shared their reflections with us as well as the many people who helped create the resources we employed.

We are particularly grateful to Jenifer Burden for her enthusiasm, counsel and total commitment to improving technical education.

We gratefully acknowledge the generous financial support from the Gatsby Charitable Foundation, which enabled this project to be completed.

1 Executive summary

1.1 The need for the project

Pedagogy in technical subjects has had much less attention than in academic subjects and students on technical courses lose out as a result. Moreover, the subject-specialist element of initial teacher education (ITE) for further education (FE) courses has been consistently criticised by Ofsted for being too weak. Within that broad context, the project described here specifically responded to a previous report for the Gatsby Charitable Foundation on ITE in the FE sector, written by Ron Thompson (2014). Thompson identified the need for research to test the benefit of applying a subject-specialist approach to the development of teachers in the sector. Focusing on ITE for teachers of science, engineering and technology (SET) in colleges, this project and the associated intervention described and evaluated in this report constitute an attempt to address that need.

The project was carried out by a team led by Professor Kevin Orr at the University of Huddersfield, which has long provided ITE for FE. An initial task for the team was to review the existing curriculum of four of the largest university providers of ITE for FE to identify subject specialist elements. Only one systematically recorded the subject specialism of trainees and provided any subject specialist input. All of the others relied on mentors alone for specialist approaches. Time and again in our data from participants, this reliance on mentors was criticised. Mentoring is an inadequate means to develop pedagogy. None of the curricula we reviewed contained any specific reference to the concepts we were to introduce, which were related to subject specialist pedagogy. For ITE in FE, therefore, this project broke new ground.

1.2 The intervention

Based on a review of literature (separately published by Gatsby, see Hanley et al 2018) the Huddersfield team initially designed an intervention based on concepts deriving from subject-specialist pedagogy to complement existing ITE courses, which was aimed at enhancing the practice of trainee teachers in SET subjects. These concepts were: pedagogy as informed decision-making; and, subordinate to that broad idea, pedagogical content knowledge (PCK); recontextualisation; and occupational identity. The initial intervention was based on face-to-face teaching as well as on-line tutorials and resources, all tailored for SET trainee teachers. The duration was around 12-14 hours in total.

Due to the low numbers of trainee teachers participating in the intervention, the team devised a related intervention for teacher educators, which represented an opportunity to cascade the ideas and resources indirectly to trainee SET teachers via their own ITE tutors. This intervention was more limited in duration but included similar activities and resources based on the same four concepts as above. It comprised a one-day session and access to the online materials.

1.3 Participants

Problems with the recruitment of participants to the intervention reflect the scarcity of in-service SET trainee teachers in FE and the difficulty colleges have in recruiting these teachers. In total the intervention was delivered to four sets of participants, two

comprising trainees (around 30 in total) and two comprising teacher educators (around 35 in total).

1.4 Evaluation of the intervention

The participants were asked to provide information before the intervention regarding their experience and understanding of subject-specialist pedagogy. Few, including the teacher educators, had more than a superficial knowledge of the concepts we were to introduce, even those concepts that are well established in teacher education literature. Participants were then contacted immediately subsequent to and again some weeks after the intervention to be asked about the impact of the intervention.

Across all four cohorts, the delivery of the sessions was very favourably received by participants, who noted that they were well-presented by experts, at a lively pace and with a good mix of activities. The videos of actual teaching practice, demonstrating different concepts in action, were a particularly popular element of each iteration of the intervention. The intervention provided an opportunity to discuss pedagogy by using subject specialism as a point of access. This allowed people who might otherwise have been sceptical or even hostile to the concept of pedagogy to engage with it.

Despite the generally enthusiastic response to the intervention from both trainees and teacher educators, however, the lasting impact on individuals' practice was limited, at least after several months. This was mainly due to conflicting pressures that restricted their capacity to innovate, mainly associated with workload and the general instability of many FE colleges at a time of cuts and mergers. For some participants it reflected a very restricted perception of what the role of a teacher is, which does not include innovation. For a few trainee teachers, lack of subject knowledge was a potential barrier. For teacher educators, the generic nature of their provision, necessary because of the range of subjects represented by their trainee teachers, was a particular barrier to adoption. Whatever the reason, there were more examples of the intervention's impact on practice, attitudes and behaviour diminishing rather than becoming embedded over time. Nonetheless, as a consequence of the intervention two major university providers have altered their curriculum for ITE to include subject specialist pedagogical approaches. Subject specialism was agreed to be a good means to promote discussion of teachers' decision-making. Moreover, the content representation (CoRe) exercises that are associated with PCK were particularly influential, even long after the sessions where they were introduced.

The project did also find strong evidence that colleges struggle to recruit SET teachers, which is a more pressing concern for many managers than is developing subject specialist pedagogy.

As a result of our intervention and its evaluation, nevertheless, we have concluded that the development of subject-specialist pedagogy for SET through ITE programmes for the FE sector is both possible and desirable for the improvement of SET teaching. This is not to oppose it to generic pedagogy, but rather to identify subject specialism as having a particular pedagogical value. There are, of course, many other factors that influence teaching and learning, including students' motivation and a supportive context for teaching but subject specialist pedagogy is worth pursuing in its own right. That is especially the case for teachers of technical subjects that do not carry the status of academic subjects. Our approach explicitly valued the subject knowledge that the technical teachers had. A model of subject-specialist pedagogy developed within a

socially-situated knowledge base that can underpin pedagogical decisions and actions, allied to the ability to reflect on the resulting decisions and their impact on students, will help teachers to continue to adapt and improve their practice as their careers progress.

2 Background to the intervention

This report explains the development and evaluation of an intervention aimed at enhancing the subject-specialist pedagogy of vocational science, engineering and technology (SET) teachers in Further Education (FE). The intervention was aimed at both trainee SET teachers and teacher educators and in various forms it complemented existing initial teacher education (ITE) courses. The research-informed development of the intervention including the production of the resources, as well as the evaluation itself, were commissioned and funded by the Gatsby Charitable Foundation.

2.1 Identifying the need for the intervention

The government's Commission on Vocational Teaching and Learning (CAVTL) noted the following in response to the question "Can we use the term pedagogy?".

> A robust vocational teaching and learning system must be underpinned by a serious focus on vocational pedagogy. And yet, as we have gone round the country visiting sites of vocational teaching and learning and in our seminars, of all the terms we have discussed the one that gets people most agitated is 'pedagogy'. (CAVTL 2013: 13)

This antipathy to the term pedagogy in relation to vocational technical courses may arise from its association with school teaching but it may also reflect a narrow perception that vocational and technical teachers only require knowledge of their craft or profession in order to teach. As Lucas et al (2012) comment, it is students on vocational courses who are most likely to lose out as a result of this antipathy. Improving pedagogy specific to SET teaching matters to those students and to industry.

Although the concept of subject-specific pedagogy is both complex and contested, there is strong evidence for its relevance as a distinct component of teachers' professional knowledge, and some evidence for its importance in relation to outcomes for learners. Evidence from schools suggests that pedagogical content knowledge – a central aspect of subject-specialist pedagogy – is important in SET subjects and mathematics, possibly more than elsewhere (see Hanley et al 2018 for a wide discussion of these issues). There is, though, a very limited research base focusing on the FE sector to inform debates on subject-specialist pedagogy and Ofsted has consistently indicated that subject-specialist ITE for the FE sector is weak (Ofsted 2003). By contrast to school ITE programmes, ITE programmes for FE are organised on a generic basis grouping all teachers together, mainly because the FE curriculum is so much more diverse that that of even a large secondary school. This has probably resulted in subject-specialist pedagogy in FE remaining very largely unexamined and under-theorised, as Thompson (2014) noted. As our research demonstrates, ITE tutors may even be unfamiliar with the well-established concepts that informed our intervention. Consequently, the ways in which issues of subject-specialist pedagogy have been addressed in FE ITE tend to be ad hoc, instrumental and over-reliant on individual mentoring relationships, as we found in our own study. In developing the intervention, we systematically reviewed the curriculum content of the four largest university providers of ITE for FE. Only one centrally recorded the specialism of their trainee teachers and had specific subject-specialist content within the course, albeit limited, which was provided through a module taught on-line and at a two-day conference held

at the university. The other providers all relied solely on mentors for any subject-specialist content on their ITE courses. These mentoring relationships are inevitably of variable quality but even the best mentor cannot in that role be expected to provide a comprehensive introduction to subject-specialist pedagogy. Within this context, Thompson in his report on ITE in FE for Gatsby highlighted the need for further research to evaluate subject specialist approaches in the development of teachers in FE (Thompson 2014: 45). This project and the intervention at its centre were a direct response to this concern, so the primary aim of our project was to test in practice the utility of subject specialist pedagogy within the context of ITE for SET teachers in FE.

2.2 The intended aim and outcomes of the intervention

The primary aim of the intervention was for trainee SET teachers to consistently improve their practice through the systematic application of subject specialist pedagogy to their own teaching context. To that end, the intervention around ITE for SET teachers and its implementation were broadly designed to:

- Translate key concepts identified as relevant to subject-specialist pedagogy into specifications of content and learning outcomes to be covered by the intervention;
- Provide learning resources, networks (including blended learning platforms) and structured activities relevant to the identified content/learning outcomes, in a form that trainee teachers can readily integrate within their teaching and teacher educators within their ITE programmes;
- Make efficient use of trainee and ITE staff time.

Specific substantive (cognitive and ability) outcomes following the intervention for trainee teachers were for participants to be able to:

- Discuss the concept of subject-specific pedagogy in relation to their own values, beliefs and competence in the practice of SET teaching;
- Identify key elements of subject-specific pedagogy, including pedagogical content knowledge, recontextualisation and ‘learning as becoming’, using appropriate language;
- Discuss and apply key principles underpinning teaching and learning in SET subject areas;
- Discuss and apply key principles related to occupational identity with relevance to vocational teaching;
- Analyse specific curriculum topics using a content representation (CoRe) approach and apply that analysis to planning, assessing and evaluating learning sessions;
- Reflect on own development needs in relation to subject knowledge and other areas of subject-specific pedagogy;
- Evaluate specialist resources and strategies for teaching and learning in the SET context.

Specific substantive (cognitive and ability) outcomes following the intervention for teacher educators were for participants to be able to:

- Discuss the concept of subject-specific pedagogy in relation to their own values, beliefs and competence in the practice of teacher education;

- Identify key elements of subject-specific pedagogy, including pedagogical content knowledge, recontextualisation, and 'learning as becoming', using appropriate language;
- Analyse ITE curriculum topics for their potential to incorporate key elements of subject-specialist pedagogy including a content representation (CoRe) approach and to further apply their analysis to planning, assessing and evaluating ITE sessions;
- Implement and evaluate concepts from the intervention in ITE programme. Evaluate intervention resources and strategies for teaching and learning in the ITE-SET context.

The outcomes for teacher educators are more limited, which reflects the shorter duration of the intervention compared to that for trainee teachers.

2.3 Aims of the evaluation of the intervention

Evaluating pedagogical interventions is notoriously difficult but we started with an explicit theory of change which we would test. Our initial theory of change was predicated on a direct intervention with trainee teachers with appropriate concepts and approaches that would positively influence their decision-making as they developed in the early part of their career. This theory of change was adapted for the subsequent intervention aimed at teacher educators. That latter intervention and theory of change were conceived to influence curriculum and practice in teacher education and so indirectly influence the development of trainee SET teachers on the ITE course. Specifically, the aims of the evaluation were as follows:

- To provide empirical evidence upon which to judge the effectiveness of subject specialist approaches to SET teaching.
- To evaluate the impact of our specific intervention and its individual components;
- To analyse participants' reactions to the intervention;
- To investigate any barriers and enablers to change associated with subject-specialist pedagogy.

2.4 Establishing a causal relationship between the intervention and the outcomes

Although there is little systematically planned development of subject-specialist pedagogy on ITE programmes, it is likely that most SET trainees will make progress in subject-specific pedagogy during their training. Some or many trainee teachers will achieve the intended outcomes to a certain extent whether or not they engaged in the intervention. We therefore applied the following strategies in order to generate confidence in our evaluation of the impact that the intervention has had on achievement of the intended outcomes:

- We used teacher educators' and trainees' own accounts of the impact of the intervention and how useful they have described it to be in relation to their planning and practice.
- These accounts were provided weeks and months after the intervention.
- We identified cognitive and linguistic markers associated with our intervention (such as the names of the concepts we introduced or the activities we used) in these accounts as a means of tracing the link between intervention's content and the actual outcomes for trainees.

Inevitably, only an association between the intervention and the outcomes can be expected. Nevertheless, these strategies generate confidence that any association observed is based on a causal relationship.

2.5 Methodology and design of the intervention

The intervention was devised by the team based at the University of Huddersfield to complement existing part-time ITE courses but would not constitute a separate module with separate assessment. Prior to the intervention, the team carried out a review of the literature associated with subject specialist pedagogy and of the evaluation of pedagogical interventions, which has been separately published by the Gatsby Charitable Foundation (see Hanley et al 2018). Based on this research, the intervention was constructed around a broad definition of pedagogy as teachers' decision-making. That is, the processes and actions through which teachers come to decisions about what will happen in their classrooms and to what purpose in relation to the specific content to be taught and the particular group of students being taught. For the purposes of our project and its evaluation, we stressed that teachers should be able to explain their decision-making.

Rather than attempt a dualistic separation of generic pedagogy and subject-specialist pedagogy, our approach emphasised the situating role of the particular technical or vocational subject in shaping pedagogical decision-making. For Winch (2010: 8), a subject involves "central organizing concepts; central facts; characteristic modes of inference which use the central organizing concepts and central facts as the basis of inferential warrants within the subject." Drawing on this concept of subject as a frame for the organisation of concepts, all pedagogy may be considered as subject specific in that a teacher enacts pedagogy through decisions and action within a specialist area. The specialist area is a crucial context and determiner for these decisions: its knowledge base, values and ways of knowing and being permeate and interact to produce pedagogical processes that are distinctive to a greater or lesser degree. Our intervention revealed that subject specialism provided a convenient point of access to discussion of all pedagogy, as explained more fully at the end of this report.

Beneath the broad definition of pedagogy as decision making informed both by subject and the particular group of students, we selected three distinct concepts to inform our intervention:

- pedagogical content knowledge (PCK), which Shulman (1987: 8) described as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding … It represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organised, represented and adapted to the diverse interests and abilities of learners, and presented for instruction." PCK lies at the intersection of content and pedagogy.
- recontextualisation, which can be understood as the social and intellectual processes of transformation by which knowledge and practices originally located in real vocational contexts are selected, organised and re-interpreted within vocational and professional curricula (see Guile et al. 2016)
- and occupational identity, building on Wenger's (1998) four interconnected components of a social theory of learning: of community, practice, identity and meaning. "Because learning transforms who we are and what we can do, it is an experience of identity. It is not just an accumulation of skills and information, but a process of becoming – to become a certain person or, conversely, to avoid becoming

a certain person" (Wenger 1998: 5). For our intervention, we included under this heading the examination of labour market information.

To demonstrate and operationalise the chosen concepts, we produced video clips of teachers teaching civil, mechanical and electrical engineering, computing, catering and animal science at four different colleges. We selected these clips to highlight decisions that the SET teachers had made in context. These videos were shown in the all-day group sessions and they were also accessible on-line as stimulus for reflection on the participants' own practice. In one clip, a mechanical engineering teacher spontaneously encourages a group of his high-level apprentices to deconstruct a gear box so they can actually see how a solenoid works. In another, a computing network teacher explains to his students how he attributes web addresses to routers based on his own vocational expertise. Three different clips show electrical engineering teachers explaining Ohm's law to their students. A civil engineering teacher in another clip explains to her class the importance of project specifications and we later see her following this explanation up with one-to-one tutorials. None of these clips was deemed to comprise an example of good or bad practice. Rather, they were used to highlight how pedagogy involves decision-making and to encourage the trainees to describe what they would do in similar situations in their own very diverse settings.

The teachers in these and many other examples were later interviewed about their decisions and what had informed them either before or during their sessions. These interviews were also videoed to be played to participants. We also videoed interviews with teachers and senior college leaders about the connections they have with industry in order to maintain the occupational currency of their curriculum.

Our intention was for the participants to construct a means to consciously systematise decision-making based on applying our selected concepts to the situation of their own teaching. To that end, on-line and classroom activities associated with the video clips required the participants to analyse others' decisions and to reflect on their own. These activities included content representation exercises (CoRe) (see Loughran et al. 2008) where the trainees used a framework of questions to select an important idea from their subject and explain what made it important, how they would introduce it and how they would assess students' understanding. The clips and the activities were carefully curated to emphasise the benefits of using abstractions to manage real-life teaching situations. There were examples of better and worse practice in the videos but our intervention was not primarily designed to provide tips or models for the trainee teachers or for the teacher educators. Our approach was to develop the participants' own teaching expertise through a structured pedagogy based on decisions informed by applying the concepts. We wanted our participants to explicitly draw on and articulate their own knowledge resources and then use the concepts we introduced to inform their decisions. Necessarily, there was simplification of the concepts and, as explained later, recontextualisation was especially difficult to adequately and quickly operationalise. The emphasis on the concepts at the level of abstraction did, however, allow them to be made relevant to all of the participants. That may not have been the case had we introduced examples of perceived good practice.

In addition to the videos of practice and interviews we produced short animations to illustrate the approaches we were advocating. We also developed class and on-line activities on the use of labour market information and how to make and maintain connections with industry. All of these resources and activities were focused on encouraging the trainees to think systematically about their own decision-making in relation to their own students and their own curriculum.

All face-to-face sessions were led by Kevin Orr and Ron Thompson, who are both experienced teacher educators for the FE sector. The intervention for both trainee teachers and teacher educators operated partly online and partly face-to-face, as outlined below, all facilitated by the team based at the University of Huddersfield.

We delivered four different models of the intervention: two were aimed at in-service SET trainee teachers, and two at teacher educators. The overall approach and content were broadly similar. With the teacher educators, however, the planned model was to act directly on the participants and so indirectly on any SET trainee teachers they then taught, with the aim of multiplying the impact. Both forms of the intervention aimed to create a common understanding of key theoretical concepts relevant to subject specialist pedagogy. These concepts could then inform specific teaching approaches relevant to the subject specialism and the students of the technical teachers.

The trainee SET teachers taught in areas that we broadly designated as follows: vocational courses in science (for example, certain BTEC courses that include biology such as animal care), engineering (including electrical and software engineering; motor vehicle subjects; we excluded construction below level 3), technology (including design technology and food technology. We excluded music technology as this, on balance, is more aesthetic than technical). The participating teacher educators' own subject specialisms were varied and few had SET backgrounds, though they all taught SET trainee teachers. By using the concepts that we identified through the review of literature (as described below) we intended that all teacher educators would be able to challenge and strengthen the pedagogical knowledge of trainees in SET subject areas.

Our trainee teacher participants were on ITE courses but they were already in post as teachers and many on a full timetable. Due to the pressures on trainee FE teachers, our intervention had to be concise if we were to recruit and keep participants. So, the intervention was designed to involve twelve to fourteen hours of engagement from participants. That is, around ten per cent additional to the normal contact time of their ITE course of 120 hours. Any less would have been too negligible; any more and we would not have recruited or retained volunteers. The intervention for trainees in Cohort 1a was spread over a period of six weeks to allow for assimilation of the concepts among the trainees and to give them time to trial aspects of our approach with their own students:

- Week 1: All-day group session to introduce concepts and subject-specialist approach (5 hours)
- Week 2: Access to on-line asynchronous activities and resources such as videos of SET teachers (around 1 hour)
- Week 3: Synchronous on-line group tutorial (45 minutes)
- Week 4: All day group session to develop application of the concepts (5 hours)
- Week 5: Access to on-line asynchronous activities and resources such as interviews with college managers (around 1 hour)
- Week 6: Synchronous on-line group tutorial (45 minutes)

It was not possible to organise synchronous tutorials with the second delivery to trainees (Cohort 1b).

The voluntary group of Teacher Educators (Cohort 2a) received one all-day session and access to the online activities and resources. For Cohort 2b, the intervention formed a three-hour segment within a wider session.

2.6 Resources and contextual supports for the intervention

The resources that supported the intervention comprised:

- Learning materials, including: resources to support collaborative and reflective activities; video of SET teaching situations and interviews with SET teachers; videos of college managers; labour market information on the SET employment context; exemplar learning materials and teaching strategies for SET curricula;
- An online platform which allowed access to learning materials;
- An online platform to allow synchronous discussion at set times (first cohort of trainees only);

Additional training materials for specific use with ITE tutors.

2.7 Ethics

Prior to any contact with participants, the project was reviewed by the School Research Integrity and Ethics Committee within the School of Education and Professional Development at the University of Huddersfield to ensure that it complied with the University's ethical procedures, which it did. All participants were informed of the nature of the project and their part in it before they consented to any involvement in the intervention and data collection. They were informed of their right to leave the study at any time without the need to provide explanation and to have any of their data destroyed. In this report as in all other documentation produced for the project all participants' names have been changed and places of work have been removed to ensure anonymisation. All data has been securely stored either in password protected electronic storage or, for paper, in locked cabinets.

The participants were provided with refreshments and lunches during the sessions but were not offered any other incentive for their involvement in the intervention or in the collection of data.

3 Our participants

Cohort 1a comprised trainee teachers who volunteered to attend after publicity in four universities (representing the largest training organisations for FE teachers in England) and their partner FE colleges. These trainees were in the second year of study for their part-time ITE qualification, and they were all employed as teachers. The other trainee teachers in Cohort 1b were on the first year of the Education and Training Foundation (ETF)'s SET for Success programme, designed to recruit and train future FE teachers for the SET sector. Pre-service trainees were not invited to participate, partly because pre-service courses generally contain very small numbers of SET teachers, and partly because the learning experiences and course structures differ significantly between pre-service and in-service courses. In any case, ninety percent of new teachers in FE are trained in service (IfL 2011).

One key factor and key finding during our project was that the total population of SET-specific trainee teachers from which to draw our sample was much smaller than originally anticipated. Trainees in Cohort 1a came from three Higher Education Institutes (HEIs), having been advertised without success at a fourth HEI. Together these institutions accounted for over 1500 trainee teachers preparing to teach in colleges and other FE and skills training providers across all subjects in the year 2014-15 (Zaidi et al 2016). From this total number we were only able to identify a population of SET trainee teachers by the definitions described above of around 50. Our final sample for the first cohort from among this limited population was, therefore, small. Initially there were eight participants, but one withdrew before the sessions after participating in the early survey and interview. Only five of the remaining seven managed to attend both days of training. This low recruitment was very disappointing but as subsequent

research for Education and Training Foundation (ETF) has confirmed, this reflects recruitment difficulties experienced by colleges across England (Hanley and Orr, in press).

There were 21 trainee SET teachers in Cohort 1b. As mentioned above, they had signed up to the SET for Success programme, commissioned by the ETF to recruit and train FE teachers. This programme also under-recruited compared with its initial target numbers, further underlining the problems attracting SET specialists into FE teaching.

As a result of the low numbers in Cohort 1a, we targeted the next iteration of the intervention at those working in teacher education for FE teachers. This approach had the potential to increase the number of trainees reached by enabling the teacher educators to disseminate the concepts, though it risked diluting the content of the intervention. Cohort 2a consisted of 15 people (mainly based in universities), involved with providing ITE, who volunteered to attend the training. Cohort 2b was a group of 21 teacher educators (mainly based in FE colleges) who received an abridged form of the training as part of another, mandatory meeting at their partner university. In their literature review, Kneale et al. (2016) failed to unearth any teacher research that explicitly compared the outcomes of voluntary versus compulsory CPD. The research reported here suggests that those participating in mandatory CPD were significantly less likely to respond to a subsequent request to take part in an evaluation, leaving insufficient numbers to draw any comparisons in terms of outcomes.

The table below sets out the numbers of participants and their involvement in the subsequent evaluation.

Table 1: Participants and their involvement in the evaluation

Cohort	Description	Date of intervention	Fieldwork	Numbers
1	Volunteer trainee teachers	Day 1 – 11 Feb 2017 Day 2 – 4 March 2017		7 attendees in total
			Pre-survey	7
			Pre-interview	5
			Day 1 evaluation	6
			Day 2 evaluation	6
			Post-interview	2
1b	SET for Teaching Success trainee teachers	Day 1 – 15 Dec 2017 Day 2 – 9 April 2018		21 of 23 attendees gave research consent
			Baseline survey	21
			Post 1 survey	15
			Day 2 – group recordings	3
			Post 2 survey	7
			Post 2 interview	4
2a	Volunteer teacher educators	22 Sept 2017 (full day)		15 attendees
			Pre-survey	15
			Plenary questions	15
			Post 1 interviews	15
			Post 2 interviews	11
2b	Non-volunteer teacher educators	13 November 2017 (part day)		c21 attendees
			Pre-survey	12
			Plenary questions	19
			Post 1 interviews	1*
			Post-1 survey	3**
			Post-2 interviews	1***

*** of 11 contacted**
**** of 19 contacted**
***** of 1 contacted**

The sample for both trainee teachers and teacher educators was small, though rather larger than in the evaluation of many other such pedagogical interventions (see discussion in Hanley and Thompson 2018). There is no claim that the samples described above are statistically representative of the population, though they do resemble the respective populations in England. The samples enable a well-informed examination of the issues associated with

developing subject specialist pedagogy for SET teachers in ITE, as the following sections demonstrate.

3.1 Analysis of data gathered from participants

Most of the data took the form of narrative responses in interviews or free text answers to survey questions. This was entered into the software package NVivo, read through for sense, and coded into key themes and patterns. The analytic approach was a mix of deductive (using as a framework the considerations that had guided the construction of the research instruments; that is, the question areas covered with participants) and inductive (developing codes emerging from the data). By the end of data collection, no significant new themes were emerging, suggesting we had reached saturation in identifying the key themes, even from a relatively small sample. Some survey questions produced quantifiable responses, and these were analysed using simple descriptive statistics.

3.2 Sample characteristics

3.2.1 Cohort 1a (volunteer trainees)

The majority of Cohort 1a were in their thirties (4/7), male (5) and teaching IT or engineering courses, most commonly at level 2. Only one was a full-time teacher, and all had been teaching their current subject specialism for fewer than four years (usually fewer than two). All but one had at least three years' experience working in an industry related to their teaching. They had volunteered to attend the intervention as professional development in addition to the teaching qualification they were undertaking.

Before the intervention, participants were asked to complete an online survey to indicate their motivation for joining the intervention as well as their level of knowledge, whichey rated various aspects of their knowledge and abilities on a 10-point scale (Table 2). On average, they were most confident about their subject-specialist knowledge. The dimensions that were less strongly rated in relation to their subject specialism were identifying their own development needs, knowledge of which teaching strategies to use and awareness of available teaching resources. Individual levels of confidence ranged from a participant who had maximum confidence on every dimension to one who recorded an average of just over 6, dipping to only 2 on awareness of teaching resources. Considering these people had put themselves forward for professional development related to subject-specialist pedagogy, suggesting they felt the need to know more, the average ratings are surprisingly high and they do not reflect their apparent knowledge during the sessions. This finding suggests that participants may have been unaware or unable to identify what they did not know in relation to subject specialist pedagogy because it was clear in the sessions that the participants had not encountered the concepts that we introduced.

Table 2: Rating of subject-specialist knowledge and abilities

Rating out of 10*	Mean score
Subject-specialist knowledge	9.1
Ability to teach your subject-specialism(s)	8.4
Knowledge about how to teach in general	8.3
Provide an alternative explanation or example when students are confused	8.1
Adapt to changing or unexpected circumstances in your teaching	8.1
Awareness of job opportunities for your students in your subject specialism(s)	8.0
Respond to difficult questions from your students	8.0
Gauge student comprehension of what you have taught	8.0
Ability to identify your own development needs	7.4
Knowledge of what teaching strategies to use	7.0
Awareness of teaching resources available	6.9

*1 = very poor to 10 = very good

They were asked to choose a topic within their own specialism, to describe what important ideas were associated with that topic, and then how they taught it. Some of the important ideas the participants identified were very functional (use a multimeter, rearrange equations, apply regulations) and others more complex (impact of e-commerce on business and society). To introduce the topic, the participants had all variously used real-life examples and so emphasised its importance. Two of them raised the challenge of the topic being potentially boring for students because of its technical or theoretical nature, and both had introduced an element of peer interaction to try and make it more engaging.

Asked why they had signed up to the programme, the most common reason was to improve teaching skills and practices (5). Just two made a subject-specific reference. Attendees were vague about the impact they hoped the programme would have on them and their teaching. In two cases, they were seeking up-to-date advice: one talked about original ideas and one about new teaching practices. A third was seeking “more variety” in his practice. Another participant (ironically, one who had self-rated at the top of all the ability scales in the pre-questionnaire) wished to increase his confidence in the subject-specialist pedagogy.

There was a range of responses about what impact participants expected the programme to have on their own students. Three hoped it would improve their students’ learning outcomes and understanding, and two mentioned increased engagement or motivation. There were also two comments about making learning more inclusive and supportive of different learning needs.

3.2.2 Cohort 1b (SET for Teaching Success trainees)

21 of the initial 23 trainees in this cohort agreed to participate in the research. Participants were overwhelmingly male (18 out of 21) and represented a broad spread of ages under 50. Older people were somewhat under-represented compared with the profile of FE teaching staff overall (ETF, 2018). Most were engineers, specialising particularly in teaching mechanical engineering. Three claimed to have some previous teaching experience prior to their current teaching role. Their prior educational achievement varied with their declared highest qualifications ranging from Level 3 to Level 8.

When asked to rate themselves on a series of teaching-related dimensions, they showed most confidence about the level of their subject knowledge (Table 3). The statements with the lowest average ratings were about choosing teaching strategies and being aware of teaching resources. Although all the ratings were consistently lower than for Cohort 1a, they were in the same rank order with the exception of "knowledge about how to teach in general" and "gauge student comprehension of what you have taught", which were even lower in relative terms. This may reflect the difference between second year trainees (Cohort 1a) and those in the first three months of their one-year course (Cohort 1b). The individual who rated himself the highest across all dimensions scored just over 9, and the lowest scored just over 4, ranging from 6 on awareness of job opportunities for students in your specialism to a low of 2 on gauging student comprehension.

Table 3: Rating of subject-specialist knowledge and abilities (Cohort 1b)

Rating out of 10* (dimensions listed in rank order of Cohort 1a)	Mean score
Subject-specialist knowledge	8.2
Ability to teach your subject-specialism(s)	7.4
Knowledge about how to teach in general	6.7
Provide an alternative explanation or example when students are confused	7.4
Adapt to changing or unexpected circumstances in your teaching	7.3
Awareness of job opportunities for your students in your subject specialism(s)	7.3
Respond to difficult questions from your students	7.1
Gauge student comprehension of what you have taught	6.7
Ability to identify your own development needs	7.2
Knowledge of what teaching strategies to use	6.4
Awareness of teaching resources available	6.4

*1 = very poor to 10 = very good

3.2.3 Cohort 2a (volunteer teacher educators)

Most of the 14 participants who completed the baseline survey had been in teacher education for some time, with nine saying ten years or more. They also had an older profile, ten being over 50 and just one under-35. Twelve of the fourteen were female. They came from a spread of disciplines, especially EFL/ESOL/adult literacy/English (6). In all, only five were from an engineering or science-related background. All of this reflects the national ITE for FE workforce.

Their trainees were or were going to be teaching in a vast range of areas; the ones most commonly mentioned were:

Childcare and Education (11)
Business and Administrative (10)
Engineering and Manufacturing (10)
Construction (10)
Creative and Design (9)
Health and Science (9)
Hair and Beauty (9)

There was a range of reasons for participants signing up for the intervention. Apart from networking opportunities (3) and updating CPD/skills (4), more than one person mentioned each of the following:

- to learn more about subject specialist pedagogy (5);
- to better support trainees (3);
- to find out more about research/project (4); and
- teaching ideas to take away (2).

All 15 claimed to have attended other professional development in relation to teacher education in the last 3 years. However, looking at the detail supplied, several of these instances related to conference attendance (6), or were internal development days (4), where it was difficult to know what, and how much, professional development would be undertaken. There was some mention of more general training content, covering e-portfolios, BME issues and innovative delivery for instance, which was not closely related to teacher education. Professional development relating to the challenge of delivering subject specialist content to a diverse audience was rarely cited. The following is an exception:

I still sometimes find it challenging to work with teachers who are delivering in very different subject areas. I have had no training in this and would welcome an opportunity to engage with the topic. (Zoe, C2a/baseline)

No one was willing to claim "a great deal" of knowledge about any of the four key concepts (Table 4). Claimed levels of knowledge were quite high for subject specialist pedagogy, and lowest for recontextualisation.

Table 4: Cohort 2a - Level of knowledge

	Claimed level of knowledge (raw numbers)			
	A great deal	Quite a lot	Not very much	Nothing at all
Subject specialist pedagogy	0	9	5	0
PCK	0	6	5	3
Occupational identity	0	4	9	1
Recontextualisation	0	1	7	6

More sophisticated and accurate descriptions were provided for subject specialist pedagogy and occupational identity than for PCK and recontextualisation, which again suggests the weak knowledge base in subject specialist pedagogy among teacher educators. They described, for example, how their trainees struggled to move from their previous vocational identity to one as a teacher, resulting in "*dual professionalism*" or "*occupying two different cultures*":

Occupational identity is how people position themselves - in FE many teachers still associate themselves primarily with the first professions rather than taking on the identity of a teacher (Tess, C2a/baseline)

3.2.4 Cohort 2b (teacher educators – compulsory attendees)

12 out of the 25 attendees completed the questionnaire. Ten of them worked at FE colleges and the other two came from HE2, which had arranged the training as part of a regular partnership day. There was a more even gender balance than in Cohort 2a, with seven females, five males, and one preferring to self-describe. Nor was the age profile so heavily

skewed towards the older end of the spectrum (although only 2 were aged under 35, 6 were 35-50 compared with 5 over 50). Perhaps reflecting this, just half (6) respondents had been in teacher education 10 years or more compared with two-thirds of the respondents from the previous cohort. Two had been teacher educators for less than a year. They came from a number of specialist areas, including two identifying their specialism as education and two each from PE/Sport, English, science, and functional skills.

Their trainees covered a diversity of areas, most commonly mentioned being:

Childcare and Education (11)
Construction (11)
Engineering and Manufacturing (11)
Business and Administrative (10)
Health and Science (10)

Most said they were attending the intervention because it was integral to the partnership meeting so they had no choice. Additional comments referred to personal development to inform practice (3 participants). Nine of the 13 respondents had attended professional development related to teacher education in the last 3 years. Most cited day conferences run by HE2, including embedding maths and English, observer training and action research.

As with Cohort 2a, we identified no one who was willing to claim “a great deal” of knowledge about any of the four key concepts. Claimed levels of knowledge were overall a little lower than for Cohort 2a, with those knowing “not very much” consistently outweighing those saying they knew “quite a lot”. As before, subject specialist pedagogy as a broad concept was the area more respondents knew about, with recontextualisation being least familiar:

Table 5: Cohort 2b – Level of knowledge

	Claimed level of knowledge (raw numbers)			
	A great deal	Quite a lot	Not very much	Nothing at all
Subject specialist pedagogy	0	5	8	0
PCK	0	1	8	3
Occupational identity	0	2	5	5
Recontextualisation	0	0	4	9

As with the C2a, examples were given of those who still define their occupational identity in direct relation to their subject specialism:

It's your own self view of what you think you do for a living. For example, I have taught a lecturer in electrical installation who stills sees himself as a 'spark', therefore his sense of occupational identity is as an electrician, not a teacher. (Michelle, 2b/baseline)

4 Key findings: trainees

4.1 Reasons for attending

The trainees who had made an active choice to take part in the intervention (Cohort 1a) were asked their reasons for attending. Five spoke about improving their teaching skills or practice, with two specifically relating it to their subject. One mentioned getting more ideas, and another meeting other STEM (science, technology, engineering and maths) professionals.

4.2 Evaluation of sessions

Reaction to the first C1a session was mostly positive, with one of the six attendees being a little more reserved in his praise and one being slightly negative in some aspects. The remainder said the session had met their expectations very well and had very clear goals and learning objectives. Most thought it would be very useful in improving their students' learning and very or quite useful in increasing students' motivation and engagement. A similar proportion thought it would be very useful in helping improve student behaviour, which was not an aim of the programme – however, it is unclear whether this was based on considered reflection or simply a "halo effect" (three participants ticked the most positive response on all the rating scales). Some trainees had found the content useful for their teacher training course as well as more broadly for their practice.

Four participants provided an answer when asked which elements of the intervention were particularly useful. One said all parts were useful, one selected PCK, and another *thinking about decisions made*. Another attendee wrote, *The info on pedagogy! It was useful as it had never been fully explained to me*. Only one person suggested an improvement, which was to provide more practical applications of the theory.

The level of enthusiasm for the second session was similar to the first, with four finding it very useful, and two saying "quite" useful. Three found the section on recontextualisation the most useful, including one who had found that working in pairs had improved his understanding of the concept. CoRe also got two mentions, with one participant having realised they *already do a lot of these things*. Another found the section on locating employment data the most useful. Three participants had spent less than two hours looking at the online materials and connected resources, with one not having looked at them at all and two (including the Day 1 non-attendee) claiming to have spent 2-5 hours using them. Asked what was most useful, two mentioned copies of the slides from Session 1. Another two referenced video clips (seemingly of the teachers) and one the animations that illustrated the concepts (such as recontextualisation) and the description of concepts with references that could be followed up. Two referred to the resources about CoRe and big ideas.

The ITE (initial teacher education) tutor in attendance found both days very useful, with interesting ideas that she could take away and use in her own planning and delivery. She was keen to share the information with colleagues, especially when planning new subject-specific sessions. It was partly her favourable reaction that inspired the later involvement of the teacher educators.

Fifteen Cohort 1b participants completed the short online survey about Day 1. Of these, ten (67%) found the session very useful and four quite useful. One said it was not very useful, because it did not relate to their subject area. Asked what was the most useful part of the session, around half mentioned pedagogy – learning more about what it meant and the theory behind it. Some mentioned the value of looking at different teaching approaches including the

video examples. Two participants specifically referred to the idea of including their own workplace experience in their lecturing, for instance:

> *The idea that you can develop into a good teacher, but its [*sic*] the embedding of your personal experiences and knowledge into your curriculum that will make you a great teacher*. (Curtis, C1b/survey 1)

4.2.1 Impact on practice

Asked what specific actions they would take as a result of the training, four of the C1a participants referred to impacts on their planning. One talked explicitly about decision-making at different points of the teaching process:

> *I will think more about decisions I make in the planning, delivery and assessment of topics.* (Brian, C1a/survey 2)

The CoRe in use

Sean, one of the trainees in Cohort 1a, gave an example of how he had used the CoRe to support his teaching. It was in relation to a course on web design and creation – something that he had no industrial experience of, nor enthusiasm for, not having enjoyed the topic when he studied it as part of his degree. He found that applying the questions from the CoRe transformed his attitude to it:

I went through the course, so I said, "What do students need to learn? What is important? What else might you know about the idea? What difficulties, limitations? What knowledge about the students' thinking that influences my teaching of the idea?" When I laid this out, I actually gave myself a much clearer idea of what I was doing. I actually enjoy doing now. Before, I just thought, "Right, I'm doing this because it's in the curriculum." Then, actually, when I did the course, I thought, "Well, action from a teacher? What do they need to know? What might they already know?" It just made everything clearer for me, and I just felt I had a better direction in what I was doing.

Five weeks after their first session, about half the SET for Success trainees who completed the survey claimed to have introduced changes to their practice as a result of that session, and all but one of the remaining participants were considering it. The one who was not intending to instigate any changes was the person who had not found the session relevant to their subject specialism. The changes identified were diverse. One referred to planning more interesting tasks so learners could "*learn for themselves*" and another was using less didactic teaching:

> *…now I employ activities and group working, which has made my life easier and improved learner retention/progress in the subjects delivered.* (Edward, C1b/survey 1)

One trainee had adopted a particular approach covered in one of the teaching videos:

> *I have used the technique where one of my students is unsure of something therefore I have involved the whole class in a recap of that particular issue to embed the learning.* (Susie, C1b/survey 1)

Two participants explained how they had been given licence to use their specialist knowledge and move away from the lesson plan if they deemed it appropriate. For instance, one of them arrived at his classroom and found the bins overflowing, as a result of which he felt confident

to make the decision that his students would spend the ninety minute session investigating and tackling the problem:

> *It all totally went off plan … using my 30 years' industry experience to teach and change things ...* (Ozzy, C1b/survey 1)

Another had started exploiting his subject knowledge to extend his students:

> *I've definitely started using more higher-level knowledge to influence my teaching, stretching and challenging my learners more definitely than I was before the sessions and not necessarily relying on the sort of lesson plans that have been written before and more relying on my knowledge of my subject to shape how lessons are taught and how they should be taught.* (Blake, C1b/2)

One trainee mentioned having "*incorporated more industry-based content"* in his work with students as a result of the sessions. Another had previously referred to his industry experience, but now considered more carefully how he was presenting it:

> *I've got this experience from being in a workplace, but I never really thought about how I was putting it across before, and if I was doing it to the best of my ability, or was just, every now and then, going, "Oh. I've had the experience of doing this", but how was I showing it?* (Sean, C1a/post 2)

Beyond the individual participants, two of the HEIs with the most trainee teachers on their courses (several hundred each year) have incorporated subject-specialist concepts into their new ITE curricula as a direct result of the intervention. This represents an enduring impact of the project.

4.2.2 Impact on knowledge and attitudes

Cohort 1a participants were asked how much they agreed or disagreed with a series of statements about whether the first session had increased their knowledge about teaching their subject specialism, their confidence in teaching it, improved their teaching skills, improved their subject knowledge and made them more likely to continue their training. Three participants agreed strongly with all five statements, and most others agreed slightly, with none disagreeing. "It has improved my subject knowledge" was a statement we had not expected to be endorsed, but only one attendee disagreed strongly, suggesting that the others had interpreted "subject knowledge" as knowledge of pedagogy/teaching rather than their subject specialism as intended.

Attendees were asked to indicate which ideas or issues had been new to them. Around half said PCK, and the same for CoRe (content representations). One had not come across "vocational identity" before, and for one, the word "didactic" was new. It should be noted that they might have come across other ideas for the first time, but as they were providing a free text answer rather than responding to a tick-list, the answers would partly reflect the relative saliency of the concepts presented.

Although participants did not say the term pedagogy was new to them, several alluded to the sessions changing or consolidating their understanding of what it was:

> *Initially I was unsure of the term pedagogy and its relevance in my sessions. What I realised particularly from the video examples was that I was already using the techniques it was showing. It was useful to be able to link the word to the practice*. (Susie, C1b/survey1)

George said he had learnt that pedagogy is:

> *All the decisions that you take, a range of decisions that you take to ensure that the lesson is engaging, people are learning, you are passing their appropriate information to your learners and you are getting, giving them the right feedback.* (George, C1b/post int)

Elsewhere, he referred to tackling elements of a topic in the correct order:

> *Subject specialist pedagogy is the process of making quality decisions in preparing lessons that is appropriate for the levels of my learners. For instance, I cannot teach my learners stress and strain without first taking them through elementary algebra and how to calculate cross-sectional areas of specific shapes common in engineering such as circular shapes*. (George, C1b/survey 2)

Another participant used to think pedagogy only related to teaching children, but has now learnt it is about "*the choices that we make"* as teachers. The intervention had made him re-think the way he had delivered scientific principles, which he recognised was traditional and didactic, whereas now he thinks:

> *…how I can make that choice to say, 'Right, okay, let's inform my planning, let's get them to do something else, let's get more experimental, let's get them to go and experience something, let's do some enrichment. We'll go to somewhere, you know, so they can see these scientific things happen. Let's get some more practical-based things. Let's get some more, kind of, higher level thinking out there. So, let's do some kind of groupwork.'* (Hamish, C1b/post int)

Some of the trainee teachers already recognised the interplay between their subject knowledge and making effective decisions during their teaching:

> *…how important it was to use our own knowledge of our subjects and in order to shape our teaching decisions to get the most out of our learners.* (Blake, C1b/post int)

> *If you have a good knowledge of the subject, a good knowledge of the subject that you are teaching it will give you, it will form a basis for choosing the right resource, choosing the right terminology, choosing the right technical terms that you want the students to learn and how they can apply the knowledge and the principles to resolving problems.* (George, C1b/post int)

Two Cohort 1b participants were keen to do more research of their own, which may indicate that the intervention based primarily on abstraction allowed the participants to seek other concepts that might be useful. One, for example, was researching Dweck's theory of motivation and its implications for learning in the classroom, and another was keen to start their own project on pedagogies for higher level apprenticeships.

4.2.3 Barriers and enablers to engagement with the intervention

Similar to the teacher educators, perceived lack of time was a persistent obstacle to completing any development, including the initial teaching qualifications in which they were all enrolled. This lack of time may be more meaningfully explained in terms of priorities set by the college, at least as understood by the participants. Brian complained that his college had insisted he follow the ITE course, but then he had insufficient time to complete a rationale and lesson plan for a teaching observation because his department was so short staffed. Hamish, who had a young child to look after, judged that his teaching had got worse whilst he had been

doing his ITE course on top of his full-time job due to pressure of time. Nonetheless, Hamish was very enthusiastic about the intervention although he had struggled when he tried to pass on his new insights to his colleagues:

> *When I've discussed it with my colleagues, they've struggled to get on board with what I've said about it being a choice, and when I sang about PCK, they've struggled to, kind of, get on board with that*. (Hamish, C1b/post int)

The intervention may have helped to liberate some participants from the straitjacket of performativity, with one trainee describing a valuable impact of the intervention as making him realise that:

> *…decision making in teaching should be based more on my own knowledge of the sector, and not what the awarding body wants.* (Blake, C1b/survey 1)

Several of the SET for Success trainees had found their mentors very helpful and supportive, but the examples they cited were more likely to focus on generic issues rather than the subject specialism. One complained that both he and his mentor would have appreciated more insight into what the relationship entailed:

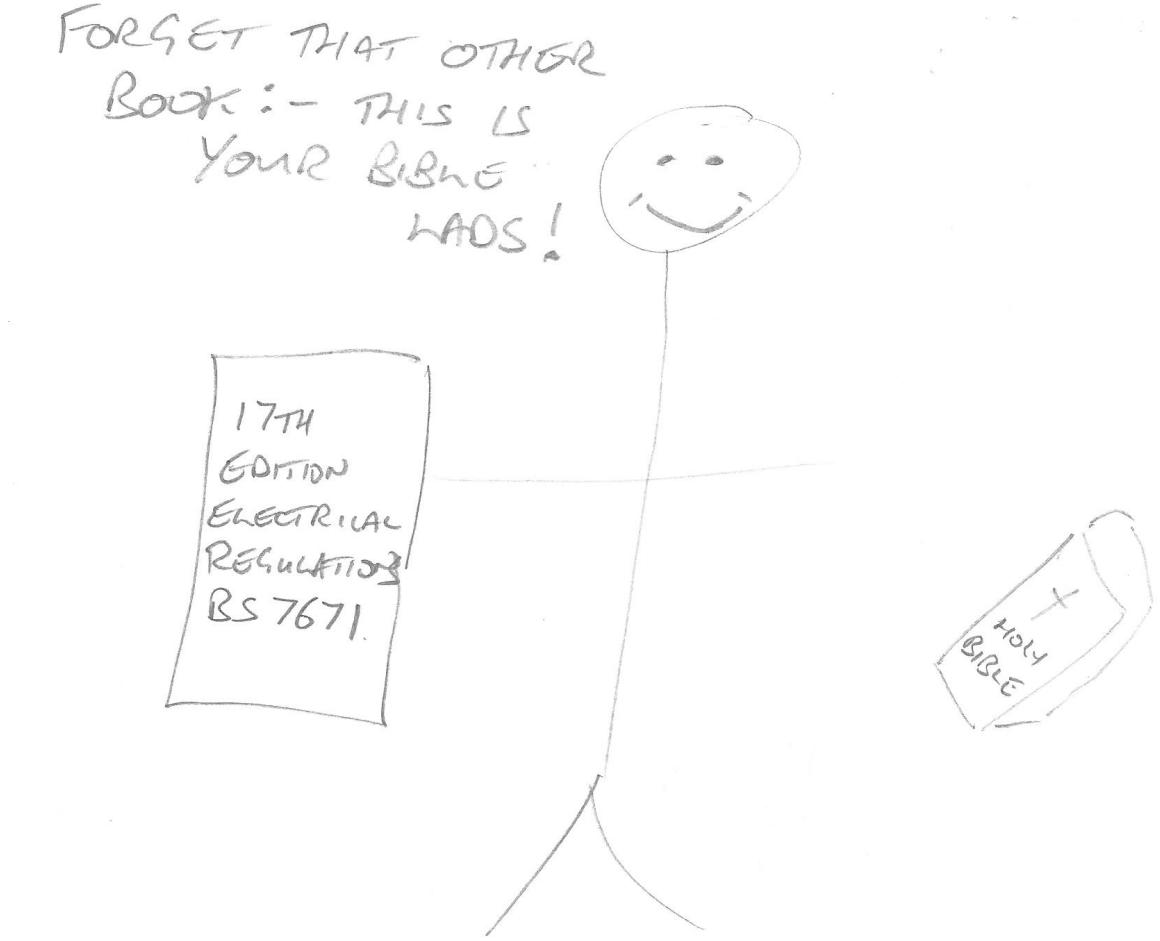
> *My mentor hadn't really been given any information about what she actually had to do to fulfil the mentor role … I wasn't too sure either, obviously I had my personal development record which she had to fill in sections every week. She had no idea about that…just a little more information I think for me and her about what it was actually prior to the course* (Blake, C1b/survey 1)

4.2.4 Self-image as teacher

Before the intervention, the five C1a trainees who were interviewed were asked to draw and describe how they saw themselves as teachers, which proved very revealing in how the participants described their role.

One was very focused on the regulations around his subject area (electrical engineering) and saw conveying these to his students as his primary task. The picture he drew of himself as a teacher shows this very plainly as he encourages students to ditch a publication they may hold sacred for a copy of the latest electrical regulations (Figure 1). It is notable, too, that his assumption of his students is that they will be male.

Figure 1: How I see myself as a teacher (Brian, C1a)



Despite having volunteered for the intervention, Brian was sceptical about his need for a teaching qualification when he had acquired so much insight on-the-job:

> *I come here with a lot of knowledge, a lot of experience. I'm an electrician, I'm teaching people to be an electrician, why do I need a teaching certificate?* (Brian, C1a/1)

He showed a similar attitude about industry experience being the only criterion needed to teach when referring to one of his colleagues:

> *He's been doing the job all his working life so it's not hard for him to teach other people to do the job, you know.* (Brian, C1a/1)

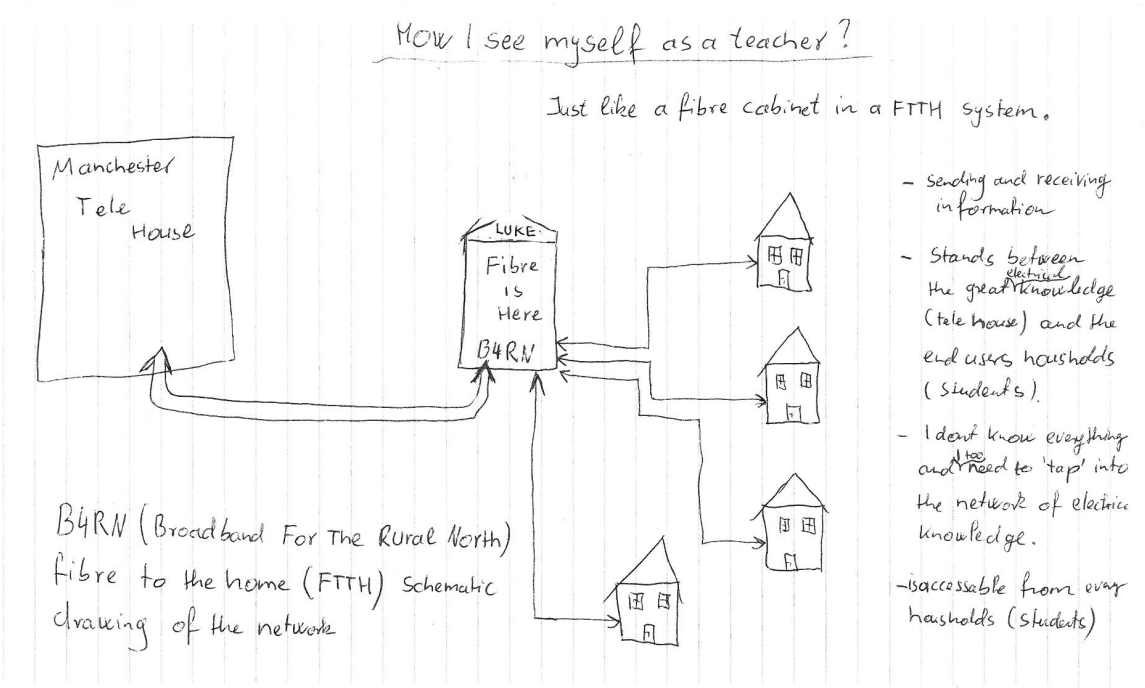
This restricted explanation of the teacher's role was reflected in the picture produced by a second electrical engineering trainee, Luke. He used the analogy of a broadband network to illustrate his teaching role. Luke saw himself as a fibre cabinet connected to the source of electrical knowledge (Manchester Tele House in Figure 2) from which he drew information when necessary. He then passed it on to "*end users*", the students (households):

> *So, there is a massive knowledge of electric which is like, you know, decades and decades been built up as mankind, need to pass it on to this handful of young men, in my class, 12 of them, and I kind of standing in-between just like the cabinet does. The*

cabinet takes in all this mass of information and dishes it out for each other's needs. (Luke, C1a/1)

This is a rather mechanistic view of the teacher as a conduit of information in a transmission model of teaching, although Luke also recognised the importance of the cabinet being accessible and approachable, so that every student could come to him with their issues. He shared, however, Brian's assumption that his students would be exclusively male.

Figure 2: How I see myself as a teacher (Luke, C1a)



Two trainees named a range of qualities that described them as teachers, with both mentioning subject knowledge, experience and giving advice/guidance. In addition, Zeb (Figure 3) included some character traits (being approachable, fair and not too strict) as well as helping students into the workplace by increasing their employability:

> *… you know, they're probably going to need to go into work so they need to understand what the world's like outside of school because they mostly have just come straight from school, straight into college, they have no idea. So, in my lessons I normally relate to what's happened in my previous life and the difficulties that I've had with some of my employees particularly those that have just come out of college or university so that they understand that they've got to stand on their own two feet, no-one's going to tell them what to do in the real world, you know what I mean?* (Zeb, C1a/1)

The second of these two trainees (Sean) added comments about his teaching style (being inclusive, composed, using demonstration and feedback) and providing leadership and direction (Figure 4).

Figure 3: How I see myself as a teacher (Zeb, C1a/1)

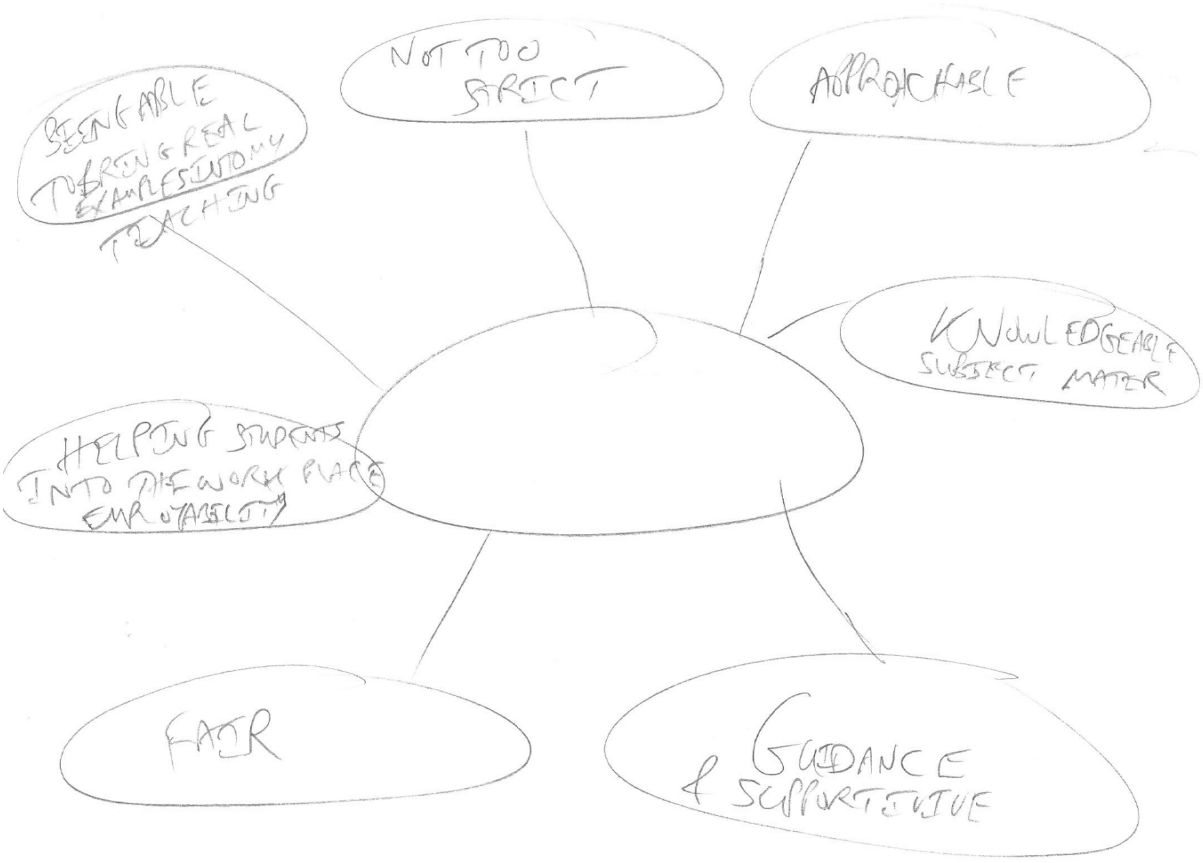
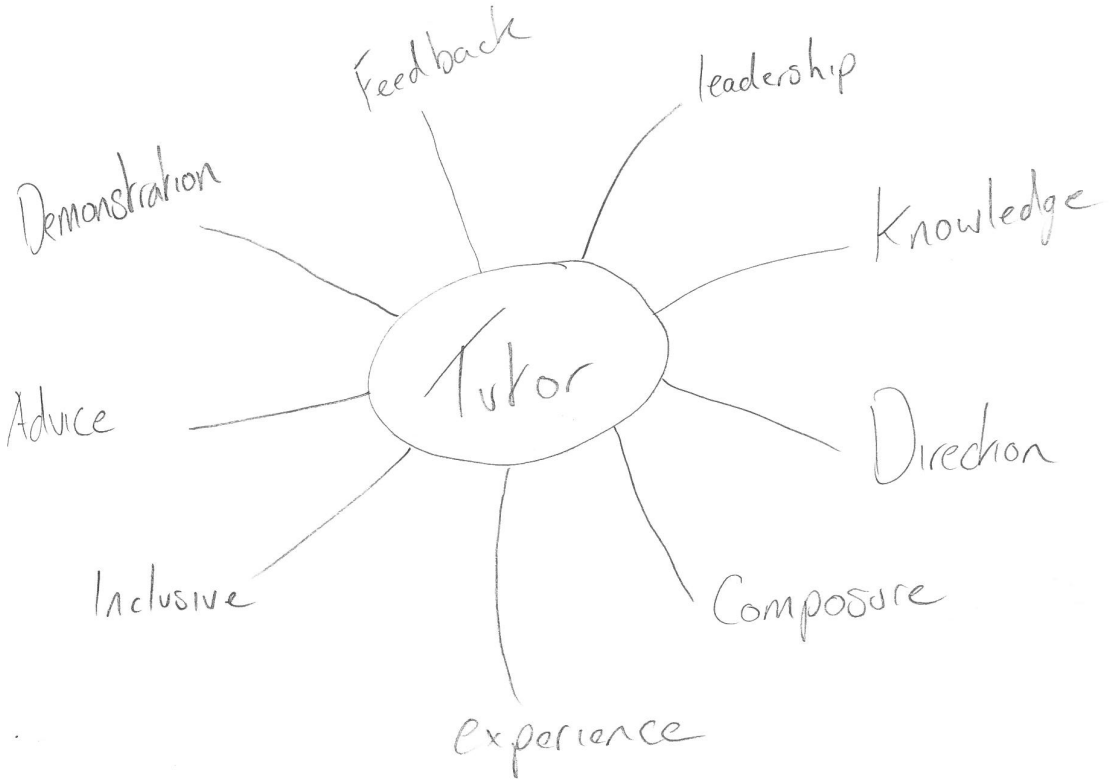
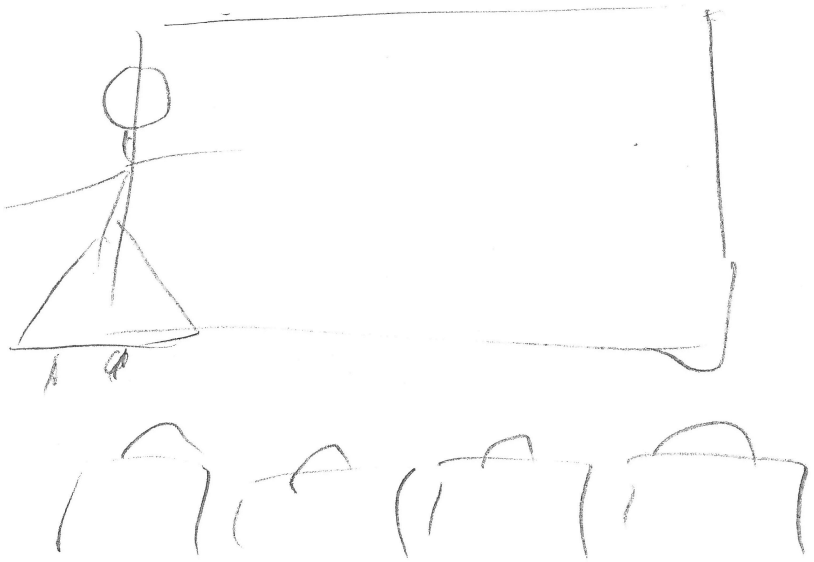


Figure 4: How I see myself as a teacher (C1a/1, Sean)



The fifth trainee (Amy) spoke exclusively about the teaching approaches she used and sketched herself at the front of a class next to a board (Figure 5). She was concerned that she used this style of teaching too much and tried to mix in videos and had once used modelling clay. She talked about having to teach students en masse and that *"… my job title is lecturer rather than teacher…".* This appeared to have an impact on how she saw her role and function in the classroom, with her approach coming across as fairly didactic.

Figure 5: How I see myself as a teacher (Amy, C1a/1)



Amy and Sean were the only two of the five to participate in an interview subsequent to the whole intervention. They were asked if they would change anything about their previous description. Amy added a rather vague "*sharing knowledge to the next generation*" to her previous teaching-focused response (Figure 5). However, Sean (Figure 4) spoke about pedagogical elements that were covered specifically in the intervention, relating to considering the student context:

> *Sean: I would probably add something more in about being better at pre-empting difficulties or limitations of students, maybe forward planning for those sorts of problems.*
>
> *Interviewer: Right, okay. Anything else that…?*
>
> *Sean: Probably something about taking into account what experience they may already have.*

These graphic self-portrayals as teachers are as varied as they are intriguing. Some suggest some interaction with students, others are very didactic but they all suggest the importance of the teachers' subject knowledge. This underlines the importance of using that knowledge as a starting point or as a motivational impetus to encourage engagement with pedagogy in order for teachers to develop their practice. The self-portrayals also suggest how important that development is.

5 Key findings: teacher educators

5.1 Evaluation of sessions

Participants overall found the sessions to have been interesting and enjoyable, leaving them feeling inspired:

> *It was actually one of the most enjoyable and instructive training sessions I've been to for a, for a while.* (Charles, C2a/1)
>
> *It was a really good day. I think we all felt that. We all came away feeling enthused about it*. (Imogen, C2a/1)

The pre-course reading (Guile et al. 2016 and Mulhall et al. 2003) received generally favourable comments. Three attendees were very enthusiastic about the content of the CoRe article (Mulhall et al. 2003) and two had found the readings useful in establishing their expectations for the session. Another participant would have liked more guidance as to how much they would be used in the session since she felt she had over-prepared. On the negative side, one dismissed them as too conceptual to be of any practical value.

Teacher educators highlighted individual aspects about the session that they had appreciated, such as the videos and activities, and the explanation of specifics like PCK and accessing labour market analysis. Some teacher educators also appreciated the networking opportunities such an event offered.

All C2a participants (volunteer participants) agreed that the conceptualisation of subject-specialist approaches to pedagogy was very useful to teacher education courses, but some raised concerns about the challenge of implementation. They identified a danger that trainees might perceive it as too complex and, more fundamentally, that teacher educators might not be aware of the key concepts and relevant literature. Certainly, even among the most experienced teacher educators there was a lack of awareness of the concepts we presented, even those concepts that are well-established in teacher education literature, such as PCK. A participant who had moved from FE to HE, Vera, questioned whether her former FE colleagues would relate to the ideas being presented. She attributed this partly to an inability to access recent research and partly to a preference for better-known concepts of pedagogy or teaching approaches:

> *We were, as a department, very sold on some more well-known ideas that might not be as important but, you know… I don't know. A different, more academic pedagogy. Weren't really aware of PCK at all. Yeah. I feel bad saying that, but that's how it was. They might know [Geoff] Petty, but they wouldn't know much… As a team, we didn't really deal with pedagogy research other than that, really*. (Vera, C2a/1)

Vera herself admitted she found it hard to grasp the theory behind and applications of PCK, although she left this admission to the end of the second interview:

> *I'm just going to be really honest. Sometimes I forget what it means. I have to remind myself – PCK and stuff like that. And it's almost as if other theory sticks, but this particular theory, I need constant reminding … if it was brought more down to the level of it fits with the mentor, it fits with, well, I don't know, like we have the specialist qualifications in English and maths, then it's really sort of solid and tangible. But I always then think, "Oh, what is it again and does it apply to all subjects?" or, "Hang on a minute, it applies to STEM but can also apply …" I'm underconfident and unsure of the concept of PCK still a little bit … my grasp of it isn't secure, theoretically, I think.* (Vera, C2a/2)

This unease with the theoretical basis that was integral to the intervention was voiced by a very small number of other participants. Rachel, for instance, felt that the session was too theory-laden, whereas she was looking for approaches she could import directly into the classroom:

> *It gave me things to think about, but nothing actually that was what I would think of as a tool that I could then think, ah, I'm going to use that and I can see how I can apply that.* (Rachel, C2a/1)

Perhaps significantly, Rachel did not actually teach on the teacher educator programme, but acted as a mentor to engineering trainees. She described her own approach to them as follows:

> *I tend to be a little bit more focused on the, this is what you're doing, have you thought about approaching it this way? Have you tackled it from that perspective? How were you thinking about delivering that aspect because learners always find that quite challenging? […] I suppose that's my natural inclination is more dealing with practicalities rather than talking about things in a more esoteric kind of way.* (Rachel, C2a/1)

Despite the content of the intervention being rooted in SET, a number of participants said they could imagine the content being transferable across subjects. Some participants suggested broadening the course focus from science, engineering and technology, since so many participants were interacting with such a diversity of trainees:

> *It would have been useful to draw out maybe some more generic things that we could use with our learners who aren't specifically in that science/technology context.* (Megan, C2a/1)

Though beyond the scope of our project, this is an entirely reasonable comment. More than one participant commented that they had become aware of how much subject specialist pedagogy they already incorporated in their practice:

> *…we are doing things already, but we didn't realise we were doing them, so when it was talking about the one task about making good decisions about vocational pedagogy, it made me think, "Actually, yeah, we are actually doing this already but perhaps we didn't realise some of these"* (Emma, C2b/2)

This suggested that for some, the intervention may have provided a name for existing practice rather than challenging or changing that practice, which falls short of the aims of the intervention.

5.2 Impact on practice

Professional development is of little value unless it informs practice, as recognised by this participant:

> *…it is all well and good us learning new knowledge, but it is about what we are doing in the classroom to make it helpful for our students.* (Emma, C2a/1)

Many participants mentioned CoRe as a new and valuable concept that the intervention had introduced and they identified a number of possible roles for it, especially as a tool for planning lesson content. The potential value of CoRe informing the design of observation schedules, and providing a framework for subsequent discussion and reflection, was also recognised. Several envisaged it operating via the trainee's mentor, to structure their observations of or discussions with trainees. That the CoRe was recalled so frequently may reflect its utility, but it may also reflect its tangibility in contrast to the abstract notions. In other words, a CoRe is easier to define and discuss than a concept like occupational identity. Despite this general enthusiasm for the CoRe, however, only one teacher educator (Debbie) had actually

introduced it to her trainees even many months after the intervention. By her first interview, she had already encouraged her first years to use it when they developed session plans. She had also recommended it to her second years, who had previously expressed a desire for some framing mechanism to support their discussions with mentors:

> *And often they say, "Well, I could do with a set of questions that would help me with my mentor, or focus me a little bit more in my subject content, because that's where I'm missing and I need some more input"* (Debbie, C2a/1)

In her second interview, Debbie reported that the questions contained within a CoRe had proved helpful to her trainee teachers in their session planning exercises, with one trainee teacher going on to use them as the basis for his actual sessions. She intended to continue with them next year:

> *…we again will probably utilise those key questions and put those into practice as well, so I think it has been quite successful in helping the students actually reflect on their practice a little bit more* (Debbie, C2a/1)

Others also referred to the potential of CoRe for focusing reflections and guiding discussions after observations:

> *I've been thinking quite a lot recently about some of the inane things we say after we've observed someone teaching, like, "How was that for you?", because it's just a stupid question.* (Megan, C2a/1)

The prospective value of the pedagogical questions in the CoRe to encourage more reflection about the reasons for teaching a topic, as well as its content and approach, applied to in-service staff and not just trainees:

> *I really thought the questions, the pedagogical questions in the CoRE structures were a really good way to get staff to reflect and think about what they're teaching, and why they're teaching it, and how they're going to teach that* (Holly, C2a/1)

Imogen wanted to encourage her trainee teachers to use the structure of the CoRe to anayse and plan their teaching. However, as an English specialist she felt constrained in being aware of the big ideas in reading, speaking and listening but not, for instance, in hairdressing or floristry. As a result, she saw it as imperative that trainees work with their mentors to establish the big ideas in their subjects. This, she envisaged, would be incorporated as a mandatory part of the form that trainees and mentors have to complete. She saw it as an approach that was adaptable for her trainees in all areas, not just in STEM. Again, however, the success of this approach is dependent on the expertise and commitment of the individual mentor. Pat also recognised the potential of working with the mentors, although she was under no illusion that this would be easy:

I think one or two of them might be a little bit lost with it because it is just sort of getting your head around the idea and the concept […] But I think once they've done that, that should actually make a difference to our mentoring programme. (Pat, C2a/1)

Another participant recognised the idea of pedagogy or content knowledge as a threshold concept in itself for teacher education. Niamh was initially interested in the CoRe from the pre-reading, in her second interview she criticised the article for being too theoretical and failing to present CoRe in a way that would be of practical value to a teacher planning a class for the following week:

> *It says it is important and people have looked at studies, whether it's significant to have better content knowledge, but not what you then do about it…* (Niamh, C2a/2)

By way of contrast, Olga found it an attractive way to consider how trainees could be helped to evaluate their subject knowledge and their teacher knowledge at the same time. She explained that it would introduce more depth than the approach currently adopted. Zoe described the CoRe as covering "*key concepts for the subject and specialist pedagogy as well*". It had alerted her to how, as a generic teacher trainer, she was unaware of many aspects of people's subject specialisms, and that the course did not fully address them either. She expressed an intention to use the approach in the forthcoming curriculum planning module.

Although around half the teacher educators had mentioned the CoRe in a positive way in their first interview, none of them (other than Debbie) had put it into practice by the second interview. Prompting revealed various vague reasons for this. Zoe, for instance, said they were something they may choose to adopt in the future "*but we're just not sure… you know, we need to discuss how we could use it*". A typology that describes patterns of adoption is discussed below.

Some of the online resources had proved popular, particularly the video clips of real-life teaching. One video clip demonstrated three contrasting ways of approaching the teaching of Ohm's law in different classroom/workshop contexts. This had proved very successful with trainees, regardless of whether they were from that subject specialism (usually they were not):

> *I think the teaching clips will be useful to […] think about how people actually do deliver and the different ways that you can deliver and it's that tacit knowledge as well that they use without necessarily realising what they're doing*. (Pat, C2a/1)

The vast majority of the participants reported, however, that they had not looked at the online materials, although most claimed they would in future. Several weeks had already elapsed since the intervention so these responses may well have been an example of trying to please the researcher. Various literature references from the intervention had, nevertheless, been added to course reading lists. This indicates that teacher educators valued the ideas within the intervention enough to incorporate them into their courses and that these ideas are being disseminated to trainees.

There were some examples of new lesson content arising from the intervention. One teacher educator had developed a session on subject specialist pedagogy. She had introduced pictures of Elizabeth I and explained how, as a history specialist, she would examine the portrayals and imagery. A matter of days after attending the session, another had engaged his first-year trainees in a debate about how to teach their specialism:

> *… what's your subject specialist knowledge and the pedagogy that helps you to get that across, and how do you develop that? And, of course, they don't have any answers because they're still thinking about these things* (Jack, C2a/1)

The intervention prompted two teacher educators to work more frequently with their trainees grouped according to their subject specialisms, which had proved a popular approach.

Three said they now took more time to model their practice to their students, though this did not closely relate to subject specialist pedagogy:

> *I think certainly in terms of me deconstructing my own practice and looking at what I do and why I'm doing it and explaining to our trainees or doing like… I've been doing with them what I call a freeze frame so I'll model something and then stop and say, right, what have I just done? Why have I done it this way, what's the reasoning behind*

> *it? Why am I doing this? What issues could come from that? And trying to get them to sort of reflect on that and see how they could then translate that into their practice* (Pat, C2a/2)

One participant from C2b had passed on to her trainees an activity looking at the teacher's role (facilitative or didactic) and different types of activities (authentic or contrived). Subsequently, many of them had incorporated it in their reflective journal and discussed the issues raised.

Some teacher educators had retained the message about decision-making being a significant element of pedagogy, and it was mentioned especially in relation to lesson planning and preparation. Asked in her second interview if her initial predictions that she would see the impact of using CoRe when observing her trainees' teaching, Debbie confirmed that she had:

> *… before the session they are being much much more focused on the activities that they are doing, and how they are supporting and differentiating the students … then that helps them with the session, because they have already got their contingency plans in place and they have thought about, well, what happens if this happens?* (Debbie, C2a/2)

Another explained that she emphasised to her trainee teachers the importance of subject knowledge in informing their decisions about how to organise their teaching:

> *…to be an effective teacher you've got to really know your subject […] so that you can make the pedagogical decisions about how you arrange it, how you arrange the learning* (Imogen, C2a/2)

One participant commented that she had already been incorporating some tasks, such as making good decisions about vocational pedagogy, into her teaching without previously being conscious of it.

5.3 Impact on knowledge and attitudes

Participants all claimed to recognise the importance of subject-specialist pedagogy. One expressed frustration that many staff she came across, including mentors, did not acknowledge that there was anything specific to the teaching of their subject. Whereas she described certain teachers as exceptions (she gave music and maths teachers as examples), many others had not consciously thought about their specialism and pedagogy:

> *Now, they might be doing that when they are teaching, they might be using, well they probably are using some specialist knowledge of how to get across difficult concepts and so on. But, they have never articulated that, so they don't realise it is there*. (Niamh, C2a/1)

For one teacher educator, the focus on subject specialist pedagogy had made her reflect on her own specialism, as someone who had come to teacher education via numerous other occupations including hotel work and training and development. She described how her trainees found it much easier to define their specialism than she did. Using the example of her own father, a plumber turned lecturer, she identified three aspects of subject specialist pedagogy: knowing your subject, putting it across well, and helping the students learn.

Some participants, despite being unable to give concrete examples of what had changed in their teaching as a result of the intervention, found that it had helped them reflect on how they delivered course content and so impacted on their personal learning. Though difficult to align

with the planned outcomes, the implication was that the intervention had affected how people might approach their role:

…it was hugely useful in terms of me taking it and raising awareness of PCK and thinking more about the subject specialist and the teacher training. I mean, it was the most useful because I hadn't really heard that from anywhere else. (Vera, C2a/2)

Emma had found the description of pedagogy helpful:

> *I particularly liked the aspect that they discussed about pedagogy describes how teachers explain the decisions they make in relation to a particular body of knowledge, and then in relation to a particular group of students. So the act of making it explicit and explain why they have made the decision.* (Emma, C2b/1)

Subject-specialist pedagogy: a lightbulb moment

For Zoe, the intervention had given her an awareness of pedagogy specific to different subjects, which was enhanced by a subsequent experience. Although primarily an ESOL teacher, staff shortages meant she had been asked to take a functional maths class. She was assured she would not need any subject specialist knowledge because the students would already have the perquisite skills. However, one student struggled to grasp a very basic concept and Zoe was not initially equipped to help him because she lacked both the subject-specific knowledge and pedagogy:

I had a student who didn't understand the whole thing about units, tens, hundreds and everything else. I didn't even realise at the time that is called number placement, I am not a maths specialist! So I was trying to show him how we work it out, but he just wasn't getting that whole thing about base ten, and so in the end, I had to have a chat to a maths specialist, I discovered it was called number placement, I went right back to some primary maths materials, and found ways of helping this student to understand what was going on. So, it was basically counting beans, so you give them 15 beans and then they have to put them – they have to separate out 10 and see how many are left over.

Zoe described this as a "*lightbulb moment*" which helped change her thinking about her discussions with trainees after observations. Her questioning had previously been quite generic as she believed there was a lot of commonality across subject areas when the class was in a workshop format. However, the intervention made her realise that "*generic pedagogy is not enough*" and the observation questions could be refined to support trainees in considering the subject specialist nature of their delivery.

5.4 Barriers and enablers to implementing subject-specialist pedagogy in ITE

Several participants acknowledged the tension between the potential usefulness of subject-specialist pedagogy and the generic nature of most teacher education courses. In the majority of cases, their trainees formed an extremely heterogeneous group that could cover specialisms ranging from childcare to hairdressing to electrical engineering. That heterogeneity is indicative of the curriculum offer of most FE colleges with scores of subjects available, rather than the dozen or so in many secondary schools. This raised two major challenges: firstly, how to adequately address all the specialisms represented within one diverse class of trainee teachers; and secondly, how the teacher educator could know enough about any one subject area to sufficiently support each individual.

Two suggested solutions had their own inherent problems. One was to form subject-specialist groupings within the class at appropriate times, but this was not possible unless the different specialisms were represented in sufficient numbers. Another solution was to use subject specialist mentors as the conduit for the ideas, as explained above. Several participants expressed the intention of passing the information on to mentors, but in subsequent interviews they had failed to meet with mentors at all, or with as many as anticipated, so the plans had not been enacted. In other cases, participants mooted that trainees themselves would be responsible for introducing their mentors to concepts such as the CoRe, but there was no evidence as to whether this had happened.

As in that instance, the problems of relying on mentors for the pedagogical development of trainee teachers was often noted, however. In colleges, mentors carried the sole responsibility for the subject-specialist input, but in practice lack of time and training for their role meant this was often not delivered.

> *I think the pattern is that mentors are really, really busy people, and they are just not spending their time with our trainees that we would like them to. And that is where a lot of this is supposed to be coming from, and I am meeting trainees who are maybe seeing their mentors two or three times a term. And it is just not enough to get that time of … to do that sort of work really.* (Zoe, C2a/1)

> *I think they see it as a burden, it's another job on top of everything that they have to do, they're not given hours for this so they do it as a favour really.* (Pat, C2a/2)

There was a recognition that many mentors had not thought about what was special in teaching their subject and consequently would not be covering it with trainees:

> *I mean some mentors are very good at supporting their students and are very reflective with their students, but others, it is quite … what is the word I am looking for … it is not particularly deep, it is quite surface the support that they actually offer.* (Debbie, C2a/2)

The teacher educators also had conflicting priorities. Many of them said it was lack of time that had prevented them from putting things into practice:

> *I think basically it's just been a bit crazy – as you know, it's that whole thing of once you go away from something it just all depends on what you manage to implement, and that's usually the trouble with attending an event, like a one-off event, is like going away and actually implement it, it sometimes just drops off the radar because things are so crazy busy* (Holly, C2a/2)

Underlining this, Vera said she had wanted to look at "the matrix" (as she referred to the CoRe) in more detail but "[hadn't] got round to doing it". Holly suggested that a second session, for instance in the form of a webinar, to co-create ideas, then share resources and lesson plans, might be a solution. A similar proposal from elsewhere was to provide more time to sit as a group and discuss how to take things forward:

> *I suppose the trouble with going on courses like that is always the thing of you have all these fantastic, new ideas and then it is implementation, isn't it? That doesn't seem to happen. And I just wonder whether maybe … I don't know, maybe we would have had time to get into a group and actually talk a bit more about how we were going to take it forward, within a session. Maybe that might have got us to do … you know, actually do something a bit more urgently you know?* Zoe (C2a/2)

The suggestion that the one-off nature of the intervention may have militated against its effectiveness receives some evidential backing. According to Desimone (2009), for instance,

the literature supports activities that are spread over several weeks and include at least 20 hours of contact time. This is closer to the delivery model adopted for the trainees in C1a and, to a lesser extent, C1b. The teacher educators did not dismiss the ideas altogether, instead phrasing it variously as putting them '*on the back burner'* or '*parked rather than a full stop'.*

Impediments to implementation identified by the participants included everyday work, college issues such as a long-lasting software failure or an Ofsted inspection, working on the revalidation of courses (although in one case this had provided an opportunity to incorporate learnings from the session) and, quite commonly, postgraduate or other qualifications that were being taken by teacher educators.

In some instances, it had been impossible to displace existing course content for the new material especially if it was perceived as less significant or well-established:

> *…there's so much that we need to get through and deliver, it's sometimes difficult to find the space for this, and therefore it tends to be less in FE as more important in primary, secondary teaching.* (Pat, C2a/1)

> *It's really important, but it tends to get overshadowed by lots of other stuff, particularly, sort of, academic pedagogy and more ideas that have been around for longer.* (Vera, C2a/1)

One participant, an engineer who provided support for learners in her own subject area, identified the lack of teacher educators with a SET background as a key barrier. She explained how these participants may have gained a grasp of the theory behind subject specialist pedagogy, but did not have the understanding of the SET subject area to apply it:

> *There were a lot of discussions around what are the problems around subject specialist pedagogy and assessing that and all the rest of it, and I just kept thinking, the problem's here in this room because if what you've got are all the people who are delivering teacher ed. have got non-technical, non-scientific, non-engineering backgrounds, then maybe that is part of the problem. Maybe what we need are people delivering teacher ed. who have got some specialist knowledge of the different kinds of areas that you deal with*. (Rachel, C2a/1)

Another C2a participant, who was himself from a literacy and numeracy background, made a similar point:

> *It would be good to have a greater variety of teacher trainers from different specialisms as it seems to me that generally they come from ESOL backgrounds or maths* (Charles, C2a/1)

More broadly the data indicates that in several institutions, pedagogical development was not the priority because pre-existing targets, action plans and teaching workload took precedence:

> *…where you've got a big list of things that need to happen by the end of the year because the college action plan and the targets are kind of set, and I worked at kind of that. Obviously there are things … if I attend something and it fits with the college actions that I'm currently working on, or the project that I'm working on, I would easily just use it* (Holly, C2a/2)

> *It's a case of managers understanding that, the need for us to be continually researching and updating our skills, and giving us time to purely focus on that rather than giving us too much to teach upon, if you will* (Emma, C2b/2)

Pat expressed a similar sentiment, acknowledging that perhaps subject-specialist pedagogy ought to be covered in initial teacher training, but this would not be possible until it became a more prominent issue:

> *It would have to be recognised as something almost that Ofsted were looking for because we chase the government agenda, we chase outstanding excellent practice and I think that governs really all that we do so if this will contribute towards a good or outstanding grade we'd provide a sort… I guess if it was a bandwagon we would certainly be on it but if it's not then probably it's not as likely.* (Pat, C2a/2)

This response is indicative of the culture of compliance in some colleges (here in specific relation to Ofsted) that may stifle development. Vera also felt that it was time for the balance to be redressed between the college demands and her own needs:

> *I kind of thought, "Okay, well, you've had two years as an institution, you've had two years of me doing what you want me to do and now I need to find a way to - focus a bit more on, you know, the teaching and learning aspect of this job rather than - and my development"* (Vera, C2a/2)

For some, the timing of the intervention delivery was critical. It had run at the beginning of the academic year and two of the participants voiced their opinion that it would have been preferable in May or June, when their workload was less overwhelming and the ideas or resources could be incorporated into their planning for the following year.

5.5 Longer-term impact

To assess the longer-term influence of the intervention, we aimed to interview participants twice. The first time was between 4 and 12 weeks after the face-to-face session (18 in one case). The timing of the second interview was suggested by the participants themselves as appropriate for catching up again later in the academic year (in practice, between May and July, which was 8 to 10 months after the session).

Several struggled to remember some of the key terms. Those who recalled them successfully were often referring to their session notes during the interview, and it was unclear whether they would have remembered the terminology or other detail unaided.

The Content Representation (CoRe) was introduced to participants both in the pre-reading (Mulhall et al., 2003) and during the session. Nine mentioned it in their first interview, with three of these (plus an additional participant) mentioning it again in their second interview. Most frequently, the term "CoRe" itself (or very occasionally content representation) was used. In four interviews (representing three participants) looser terms were used. Descriptions included "*matrix*" or "*grid*" featuring "*key ideas*" or "*important concepts*". In another instance, CoRes were described as "*models from the pre-reading*" which provided a "*framework*" for trainees to think about "*their teacher knowledge and subject knowledge at the same time*".

Comparing the first and second post-session interviews of the teacher educators suggests that any impact of the professional development was as likely, if not more likely, to diminish as to become embedded in practice over the months:

> *I used a couple of things immediately, and then everything else sort of went on the backburner and you do forget … I think the key things that stood out to me have sort of gone and have helped to sort of shape things, but other things I think that probably would have been very useful have sort of just vanished in the sort of melee of the year really* (Tess, C2a/2)

Of the 12 participants who were interviewed twice, the number reporting no impact rose from 2 to 4; those expressing intentions to do something stayed steady at four; and the number describing actual impacts on recent practice fell from 6 to 4. The low numbers involved means these trends are indicative only, but the typology (section 6.3) seeks to define what we have found.

6 Discussion of findings

6.1 The unstable context for FE

The entire project coincided with a period of significant cuts in funding in English FE colleges and, associated with that, the merger or mooted merger of many colleges. The instability of that situation is an important contextual factor for all of the participants. So too is the heavy workload that was similarly common to all of our participants. These factors are likely to have restricted the capacity for any intervention to change practice, let alone one that demanded the engagement that we sought. While a subject specialist approach to pedagogy may indicate a possible means to improve SET teaching, it does not address issues around the recruitment and retention of teachers, their workload and job insecurity that will limit any current pedagogical development in England's FE colleges. Similarly, the very low numbers of trainee SET teachers that hampered this project is a very significant issue for any new initiative in the sector. Good pedagogy matters, but the recruitment of teachers is a higher order issue.

6.2 Subject as an impetus for pedagogical development

The contextual caveat above needs to be considered carefully in relation to any of our findings. Nevertheless, as a result of our intervention and its evaluation, we conclude that highlighting subject specialist knowledge to inform teachers' decisions is a successful route to engagement with pedagogy, which otherwise may be resisted. Most but not all of the participants, whether trainee teachers or teacher educators, were enthusiastic about the intervention, partly because of the opportunity to think carefully about teaching practice and what informs that practice. The model of subject-specialist pedagogy developed within a socially-situated knowledge base that we adopted can underpin pedagogical decisions and actions. More precisely, we have found evidence to suggest that the development of subject-specialist pedagogy for SET through ITE programmes for the FE sector is both possible and desirable for the improvement of SET teaching.

Starting from abstractions such as PCK or occupational identity has meant the approach can adapt to the situation of participants in a way that narrower models of good practice cannot. Allied with the ability to reflect on the resulting decisions and their impact on students, this approach to pedagogy may enable SET teachers, and others, to continue to adjust and improve their practice through their career. There are, of course, many other factors that influence teaching and learning, including students' motivation and a supportive context for teaching, but our findings suggest that subject specialist pedagogy is worth pursuing in its own right.

6.2.1 Pedagogy as decision-making

The decision to operationalise pedagogy around informed decision-making was broadly supported in the data from trainees and educators, who understood the concept and could relate it to their planning and practice. PCK and CoRe activities were most commonly noted

in the data gathered following the intervention as was the specific use of labour market data. Recontextualisation proved much more difficult for participants to rationalise as a means to inform decisions, at least in the very restricted time our intervention had, and it was the concept least likely to be identified in subsequent data. With more time for the intervention or with fuller integration with the ITE course, recontextualisation may have been more readily adopted by participants.

6.2.2 A sustainable approach to pedagogical development in SET teaching in colleges

For our project, involving teacher educators was a more sustainable way of promoting better pedagogy than working directly with trainees, who proved difficult to recruit. One teacher educator who fully adopts the approach may, moreover, influence scores of teachers over just a few years. The specific focus on SET may be dissipated, of course, lost but the relationship between subject and pedagogy persists. Concepts such as PCK and recontextualisation associated with subject-specialist or vocational pedagogy were unfamiliar to all of the trainee teachers and most of the teacher educators, which alone is significant.

Subject-specialist pedagogy demands strong subject knowledge and for the intervention we assumed that the participants had sufficient knowledge. In practice, most but not all of the trainee teachers did have sufficient subject expertise to be able to engage with the intervention. Our intervention could do nothing to address any lack in knowledge, however.

6.3 Adoption of professional development: a typology

As a result of the emerging patterns of adoption of the approach we promoted, we propose a typology to describe the differential adoption of professional development and how this adoption may change over time. We identified four broad types of participant as follows:

> **Sustainer** – actual impact on actions reported at both stages, soon after the intervention and much later;
>
> **Enthusiast** – at both stages, reported intentions only; or weakened from actual change to intended action;
>
> **Discontinuer** – actual impact reported in first interview but then subsequently lapsed to no impact;
>
> **Non-adopter** – did not report any impact at either stage, little or no engagement.

Although these categories intersect, they each convey the different ways individuals responded to our intervention and, perhaps, more generally to professional development over time. Importantly, the patterns of adoption personified in these categories are affected by individual characteristics such as enthusiasm and knowledge, but also by the circumstances of the participant. Those circumstances might offer encouragement for professional development but they might constrict professional development. Crucial to that are both the attitude of management and the teacher's workload, for example. This typology may help to explain how new approaches become differently embedded in practitioners' thinking and practice; most of our participants were in the first two categories. This typology also indicates how difficult it is to implement change in the FE sector, which has implications well beyond our project.

6.4 Mentors and subject specialist pedagogy

Each trainee teacher had a mentor and this mentoring relationship was most frequently identified by participants as the current means to introduce subject specialist pedagogy. The quality of mentoring on ITE courses is, at best, inconsistent but even asking the best mentor with the most eager mentee to introduce subject-specialist pedagogy is asking the mentor to go well beyond that mentoring role. Pedagogy is best introduced through teaching not mentoring, which is about general support. So it is not just a lack of time or inclination that is limiting the development of subject specialist pedagogy through mentors on ITE courses, it is a category error relating to the role and purpose of mentors. High quality ITE must include subject specialist pedagogy, which means incorporating it into the content of the course, not leaving it to mentors, who have a different important job to do.

6.5 Online materials and the legacy of the project

Each iteration of the intervention had included an on-line element as an integral part of the general blended approach. The later decision to produce resources and activities that were exclusively available online reflected both the difficulty in finding participants for face-to-face professional development sessions but also the intention to extend the reach of the project beyond the end of intervention. The resulting online platform is housed on Gatsby's website and is available at: https://www.improvingtechnicaleducation.org.uk/teacher-education.

This is a lasting legacy of the project which, we hope, will be of use to SET teachers well into the future as they develop their subject-specialist pedagogy. Each aspect of the resources has been designed so as not to mention specific courses or qualifications in order that the resources avoid obsolescence and are relevant in varied settings. The class videos, animations and interviews form the original sessions have been augmented to align with a pedagogy better suited to the on-line environment and the whole website is attractive and the pathways are easy to follow. Only the trainee teacher pathway is currently available on the platform and it has been well received by teacher educators but we have no data available yet on how it has been accessed or on any impact it has had. Eventually there will be pathways for teacher educators; qualified teachers seeking professional development; and staff with responsibility for providing or organising CPD.

7 References

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*,181–199.

Education and Train Foundation (ETF) (2018). *Further Education workforce data for England: Analysis of the 2016-2017 Staff Individualised Record (SIR) data*. London: Education and Training Foundation.

Guile, D., Kersh, N., & Tiris, M. (2016). Enhancing SET teaching at level 3. London: Gatsby Foundation.

Hanley, P., Hepworth, J., Orr. K. & Thompson, R. (2018) Literature Review of Subject Specialist Pedagogy, London: Gatsby Charitable Foundation. Available online at http://www.gatsby.org.uk/uploads/education/literature-review-of-subject-specialist-pedagogy.pdf

Hanley, P. & Orr, K. (in press) The recruitment of VET teachers and the failure of policy in England's further education sector, *Journal of Education and Work.*

IfL (2011) *What 5,000 further education teachers and trainers think about initial teacher training*. London: Institute for Learning.

Kneale, P., Winter, J., Turner, R., Spowart, L., Hughes, J., McKenna, C. & Muneer, R. (2016) *Evaluating Teaching Development in Higher Education. Towards Impact Assessment: Literature Review*. York: Higher Education Academy. Available online at https://www.heacademy.ac.uk/system/files/evaluating_teaching_development_in_he_-_literature_review1_1.pdf

Loughran, J., Mulhall, P. & Berry, A. (2008) Exploring pedagogical content knowledge in science teacher education. International Journal of Science Education, 30(10), 1301-1320.

Lucas, B., Spencer, E. & Claxton, G. (2012). *How to teach vocational education: A theory of vocational pedagogy*, London: City and Guilds.

Mulhall, P., Berry, A., & Loughran, J. (2003). Frameworks for representing science teachers' pedagogical content knowledge. In *Asia-Pacific Forum on Science Learning and Teaching 4*(2), 1-25.

Ofsted (2003) The Initial Training of Further Education Teachers: A survey. London: Office for Standards in Education.

Thompson, R. (2014) Initial Teacher Education for the Education and Training Sector in England: Development and change in generic and subject specialist provision. London: Gatsby Charitable Foundation. Available online at http://www.gatsby.org.uk/uploads/education/reports/pdf/initial-teacher-education-for-the-education-and-training-sector.pdf

Shulman, L. (1987). Knowledge and teaching: foundations of the new reform. Harvard Educational Review, 57(1), 1-22.

Wenger, E. (1998). Communities of practice: Learning, meaning and identity. Cambridge: Cambridge University Press.

Winch, C. (2010) *Dimensions of Expertise: A Conceptual Exploration of Vocational Knowledge*, London: Continuum.

Zaidi, A., Howat, C. and Caisl, J. (2016). *Initial Teacher Education Provision in FE: second year report*. London: ETF.