



Enhancing SET Teaching at Level 3

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I. Executive Summary

The initial source of motivation for this report was the national response to the Commission on Adult Vocational Teaching and Learning (CAVTL) Report *It's All About Work* (2013), and it addresses an issue that remains relevant to the current discussion about the creation of Professional and Technical Pathways to employment - the contribution that excellent vocational teaching and learning makes to the development of the forms of expertise that employers' require and that facilitate learners' continuing employability.

In the course of discussions between the Gatsby Foundation and the research team the following rationale, focus and outcome was agreed. In the case of the former, to develop a conceptual framework to investigate vocational pedagogy that drew on insights from the academic and grey literature and, in the case of focus, to use that framework to investigate learning and teaching in Science, Engineering and Technology (SET) programmes at Level 3 in a variety of SET contexts. In order to do so, it was recognised that it would be important for the research team to take account of the way in which colleges respond to known as well as emerging employer demand for SET skills.

A number of different, but complementary, insights emerged from the review of the research and grey literature on vocational learning and teaching. The main cross cutting insight is that vocational pedagogy is different from academic pedagogy because it serves a dual purpose: to prepare someone with the occupationally-relevant or occupationally-related knowledge and skill to make the transition to employment (clear line of sight to work) and to succeed with the academic elements of their programme of study. The main difference is that whereas the research literature provides a number of conceptual insights as regards how to think about the design and delivery of vocational learning and teaching, the grey literature tends to identify and/or affirm the value of specific aspects of learning and teaching, for example, differentiated tasks, work experience, assessment etc.

The value of developing a conceptual framework to investigate the distinctive features of vocational learning and teaching has led the report to identify that boundary crossing is a *continuous* feature of a college's work to enhance the quality of vocational learning and teaching, rather than as CAVTL maintained a special feature of vocational learning and teaching. The four main boundaries this report has identified that have to be continually crossed are between: a) colleges, local employers and communities, learners and families; b) pre-given course and qualification requirements and local employer needs; c) theoretical and practical learning; and d)

learners' initial interests and preoccupations and their potential to expand their horizons, through participating in the range of learning and teaching activities within the college they are attending, through work experience, and as a result of their own self-directed efforts.

In making this argument, the report has shed significant light on a number of issues. They are to:

- re-affirm the importance of employers and colleges planning, co-designing and, where feasible, co-delivering vocational programmes and, in the process, revealing the importance of defining vocational pedagogy as ways to connect different spheres of learning;
- illustrate the diverse ways that colleges use *modularisation* to create courses that reflect changing employer demands and by doing so draw attention to the importance of preparing new and experienced members of the teaching profession to learn how to *tailor* vocational provision;
- introduce a new language of description – *practice-theory* – to enable all parties involved with VLT to think about new ways to support learners to connect theory and practice to one another and, in the process, to overcome the inhibiting legacy of the phrase 'apply theory to practice' in vocational learning and teaching;
- draw attention to the relationship between *expansive*, compared to restrictive, workplace environments for the *outcomes* that learners can achieve from work experience and work placements;
- highlight the added value that *mobile* learning as opposed to ICT contributes to the vocational learning and teaching;
- and, finally, identify a range of ways that *employer involvement* with *assessment* allows college to incorporate aspects of the assessment cultures of different occupations and sectors and, in the process, enhance learners occupationally-specific employability skills.

2. Introduction and background

The rationale for this report is the widespread recognition over the last few years since the publication in 2013 of the report from the Commission on Adult Vocational Teaching and Learning (CAVTL) through to the current discussion about the creation of Professional and Technical Pathways to employment, that more needs to be known about the contribution that excellent vocational teaching and learning makes to the development of the forms of expertise that employers' require and that facilitate learners' continuing employability.

The aim of this research, which has been funded by the Gatsby Charitable Foundation, is to identify excellence in learning and teaching in Science, Engineering and Technology (SET) areas at Level 3, and to use the findings from the research to provide staff involved teaching SET programmes with fresh insights into how they might enhance their pedagogic practice.

We hope that these findings may be useful for policymakers looking at future provision of vocational learning and teaching.

The first section of this report consists of a review of the literature of what the report refers to as, vocational learning and teaching (VLT). This provides a picture of excellent vocational learning and teaching practice as reported in the existing research and grey literature, and its implications for SET. Specifically, the review aims to:

- Distil from the academic research and grey literature that discuss and identify excellent vocational teaching and learning practice, conceptual and practical pedagogic insights;
- Use these insights to generate a framework to investigate VLT in five case studies in different occupational contexts undertaken as part of this research;
- Identify from the case studies a number of issues about excellent vocational teaching and learning practice and show how they reinforce, add or go beyond the characteristics of excellent practice identified in Recommendation 6 in the CAVTL report.

3. The context for the research and review of literature

3.1. Vocational Education and Training (VET) in England

Historically, vocational education and training (VET) in England has been undervalued and compared unfavourably with that found in many other advanced economies (see for a summary of the key issues (Winch *et al.* 2011) or subject to a number of high profile attempts to ensure VET has parity of esteem with academic qualifications (see Pring *et al.*, 2009). Both developments have tended to firstly, gloss over the diversity of vocational programmes that exist in England. At the present time VET consists of a number of: (i) programmes, which are a part of the National Qualification Framework (NQF) or the Qualification Credit Framework (QCF). The former tends to be characterised by ‘general’, for example, OCR AS/A Level Biology, and the latter by ‘technical’ qualifications, for example, BTEC Electrical Engineering, qualifications offered from Level 2 upwards which are offered to learners enrolled in Further Education Colleges; (ii) work-based qualifications that enable a learner to demonstrate competences, for example, NVQs from Level 2 upwards; and (iii) apprenticeships which may, at Level 3, offer learners access to NQF or QCF qualifications as well as NVQs. Secondly, rarely identify examples of excellent vocational learning and teaching practice, with the result that successes have tended to remain under the radar because of the fragmentary character of UK VET, rather than acting as triggers to develop and improve the quality of vocational learning and teaching in Further Education Colleges and private training providers in England.

The aim of this report is to highlight the latter rather than re-rehearse the debates about the inadequacies of VET in England or the attempts to achieve parity of esteem between vocational and academic qualifications. For this reason, the report takes the CAVTL Report “It’s All About Work” as the starting point for its discussion of VET. Before doing so, the report provides an overview of developments in VET in the England and Europe.

3.2 VET in England and Europe

It is widely accepted that vocational education and training can play a central role in preparing people for work and life and there is evidence (OECD Review of Vocational Education and Training 2011) that strong vocational programmes increase competitiveness and are beneficial to the economy. In the case of England there is a mixed picture as regards the availability of technical skills: sometimes there is a mismatch between the programmes

offered by educational institutions and the skills needed in rapidly changing sectors, such as aerospace (Lewis, 2012), and sometimes there is evidence that colleges and employers are working closely together to develop “skills ecologies” to grow the required skills (Hodgson and Spours, 2015).

Vocational education has been undergoing constant re-appraisal in many countries (Lucas and Claxton 2010) and all four nations of the UK have been reforming their curriculum for 14-19 year olds, using vocational qualifications as one driver of change. Building on the replacement of lengthy courses with terminal assessment with modularisation, (i.e. discrete and relatively short learning experiences with linked assessment, as a curriculum strategy in the late 1980s (Young 1998), these reforms have placed an emphasis on flexible, transferable skills such as teamwork, problem solving, an enterprising attitude and the ability to communicate confidently with customers and colleagues. In the case of England, over the last 30 years this focus on the outcome from vocational courses has contributed to a shift from a concern for curriculum development and pedagogy to qualifications design. The shift to a qualification-driven funding regime has exacerbated a focus on ‘assessment as learning’ and qualifications as a proxy measure for knowledge and skill (Guile, 2004).

Yet the above trend is set against a backdrop where VET has until recently played second fiddle in policy circles when compared to academic education (OECD 2011). Moreover, information about VET systematically collected to assist policy formulation, with limited data sets available that would allow reliable comparisons across countries. The funding by the Department of Business, Industry and Skills (BIS) of the Vocational Education Research Centre, London School of Economics, as may change that situation in England as may the establishment at UCL of centres for Engineering Education and Education and Work. Furthermore, VET has tended to be seen as having low status by students and the general public, though this is not universal across all countries, and this as much as poor career guidance because “those offering guidance are inadequately acquainted with labour market issues” can adversely affect recruitment onto VET programmes (OECD 2011).

Although the attractiveness, quality and perception of VET vary significantly across EU countries, this perceived lack of value is not reflected in the employment market, certainly not in the short to medium term. The European Commission (Working for better skills and

growth, 2012) working document cites evidence that VET graduates have improved work prospects than those from academic backgrounds. Cedefop (2010) data shows that that employment rates for medium level (Level 3 and 4) European VET graduates aged 20-34 with strong workplace orientation, are actually more successful than candidates from general education in finding employment. The same data also shows that VET candidates are initially better paid than candidates from general education, but this decreases over time. Hidden in the depths of this policy report are features identified as excellence in VET, from systems level down to the individual, based on lessons from practice. These include steps to increase VET attractiveness, including a number of campaigns and skills competition together with evidence on the effectiveness of funding and incentives mechanisms to stimulate participation in VET and increase attractiveness. It also recommends fostering work-based learning (WBL) and cooperation between VET institutions and employers. The paper also comments on how the boundaries of VET have been shifting, with vocational qualifications spreading across higher levels reflecting the need for vocational skills and competences at advanced levels (see for a most recent discussion of this issue Deissinger, *et al.* 2013). Those participating in initial vocational training (IVET) need to develop not only the relevant technical skills, but also to learn to cope with change, complexity and the need for continuous skills development. There is clearly not only demand for employees to achieve at level 3, but to show that they have the capability to progress to higher levels.

This conclusion is supported by a number of writers, for example, Lucas *et al.* (2012) and Winch *et al.* (2011) who note that traditionally vocational education outcomes have been framed in terms of skills or competencies relating to particular vocational domains with, recently, a greater interest in basic skills (in literacy, numeracy and IT for example), and also in what are increasingly referred to as 21st century or wider skills. They go on to argue that there are a number of capabilities that make up the working competence of a vocational worker, and these add to – rather than being a different set from – the set of capabilities required of ‘academic’ workers (Winch 2014). The modern workforce needs increased knowledge, capability for decision-making and dealing with the non-routine, and troubleshooting and other skills to deal with the many unexpected situations they will encounter in the real world. This is a far cry from the image of a vocational worker as a low skilled individual only capable of manual tasks. There is also evidence (UKCES Working Futures, 2008) of changing trends in patterns of employment, with declining employment

levels projected for purely skilled trades and increasing higher level occupations in the associate professional and technical occupations.

Whether the change is due to the impact of technology (Institute for the Future [2011] Future Work Skills 2020) or employers demanding a more flexible and capable workforce for the modern world, or a combination of both factors, is beyond the scope of this report to investigate; the world of work has now changed and so have the skill sets required which now require much more analytical and higher order thinking. This represents something of a sea change in terms of VET, and one which ultimately imposes a requirement on vocational workers to demonstrate the potential to develop higher level thinking skills, as well as practical competences. If the balance in vocational education has shifted, the impact on VET organisations and teachers is that they have to develop the VET curriculum, and VET learners, in ways which cultivate the development of higher order thinking skills.

One issue that informs the above sea change is innovation in the workplace: technological developments that generate new skills; occupational developments that generate new employment opportunities; and developments in the division of labour that transform the nature of and demand for skills. The relationship between VET and innovation in Europe is currently under review by the OECD (www.oecd.org/edu/innovation). A major concern is the responsiveness of VET systems to workplace innovation. This raises in England the following questions for VET policymakers, practitioners and researchers:

- how do Further Education Colleges and private sector training providers anticipate trends so they are positioned to respond to employers' future skills needs?
- and, what support do they need to do so and who should provide such support?

These questions will be returned to in the conclusion of the report.

4 Review of Vocational Learning and Teaching

4.1. Introduction

The starting point for this review is the report *its All About Work* (2013) from the Commission for Adult Vocational Teaching and Learning (CAVTL) which addressed the question – what constitutes excellent vocational pedagogy? – and concluded that vocational pedagogy was very different from academic pedagogy. To explore this issue, the report starts by drawing on what is commonly referred to as the grey literature, often research informed, about vocational learning and pedagogy which has either been commissioned to influence thinking about these issues in England’s education and training sector or commissioned to urge national and international policymakers to prioritise VET more explicitly. It then proceeds to discuss the research literature on vocational learning and teaching, including vocational knowledge. The review has imposed a tight boundary around its selection of research included in the latter category. The criteria underpinning the cited work are: (i) the extent to which they address issues about curriculum and pedagogy that are relevant to vocational learning and teaching; and (ii) consistent with the *learner-centred* (i.e. using pedagogic strategies to assist learners to construct their understanding of concepts) of English vocational learning and teaching, rather than *teacher-centred* (i.e. using pedagogic strategies to transmit concepts to learners), characteristic of English as opposed to some European vocational learning and teaching. The implications of this observation will be returned to later.

The above eclectic selection of literature will enable the report to: (i) address important conceptual issues which frame current conceptions of vocational teaching and learning in policy and research circles in England; and (ii) identify practical issues that will help SET lecturer to enhance the quality of the design and delivery of curricula and pedagogy.

4.2. Vocational pedagogy: the starting point

One outcome of the publication by BIS of a reform plan *New Challenges, New Chances* in 2011 (BIS, 2011) for the further education and skills sector was the establishment of an independent Commission on Adult Vocational Teaching and Learning (CAVTL). The commission had the remit to advise on how to ‘raise the quality, and improve the outcomes and impact, of adult vocational teaching and learning in the further education and skills sector

for learners and employers.’ The CAVTL report specifically focused on adult vocational education and training (VET) rather than the whole of the further education and training sector and investigated the definition and use of a number of key terms. For example, reflecting the Commission’s broad canvas, the term ‘vocational learner’ is used to include students, trainees, apprentices, and employees and covers those from age 14 in the further education and training sector.

Drawing on the visits to colleges and companies, seminars, and evidence submitted to the Commission from researchers, employers and professional associations, the report established what was distinctive about vocational pedagogy by distinguishing between its context and features. The former was defined in terms of the four characteristics on which excellent programmes of adult vocational teaching and learning depend:

- clear line of sight to work on all vocational programmes;
- ‘dual professional’ teachers and trainers who combine occupational and pedagogical expertise, and are trusted and given the time to develop partnerships and curricula with employers;
- access to industry-standard facilities and resources reflecting the ways in which technology is transforming work;
- clear escalators to higher level vocational learning, developing and combining deep knowledge and skills.

The features of vocational pedagogy were identified as follows:

- through the combination of sustained practice and the understanding of theory, occupational expertise is developed;
- work-related attributes are central to the development of occupational expertise;
- practical problem solving and critical reflection on experience, including learning from mistakes in real and simulated settings, are central to effective vocational teaching and learning;
- vocational teaching and learning is most effective when it is collaborative and contextualised, taking place within communities of practice which involve different types of ‘teacher’ and capitalise on the experience and knowledge of all learners;

- technology plays a key role because keeping on top of technological advances is an essential part of the occupational expertise required in any workplace;
- it requires a range of assessment and feedback methods that involve both ‘teachers’ and learners, and which reflect the specific assessment cultures of different occupations and sectors;
- it often benefits from operating across more than one setting, including a real or simulated workplace, as well as the classroom and workshop, to develop the capacity to learn and apply that learning in different settings, just as at work;
- occupational standards are dynamic, evolving to reflect advances in work practices, and that through collective learning, transformation in quality and efficiency is achieved.

Initially, the use of the term pedagogy in the report proved to be something of a grey area where the vocational field is concerned because the term ‘pedagogy’ has been associated with primary and secondary education and the term ‘andragogy’ associated with adults. The CAVTL supplementary papers later recorded that the term vocational pedagogy gradually became to be seen as ‘helpful’ more widely in the vocational field (see LSIS (2013b), not least because employers and others are comfortable using the term pedagogy to refer to workplace learning. By outlining a comprehensive range of pedagogic strategies (collaboration), tactics, (access to occupational communities of practice, contextualising theory and assessment) and issues (occupational standards), the CAVTL report located the concept of *pedagogy* at the heart of discussions about the process of vocational learning amongst practitioners and in addition elevated vocational teaching and learning into a national topic of discussion amongst vocational stakeholders.

4.3. Vocational pedagogy: further issues

In this period, the issue of vocational pedagogy proved to be attractive to various august bodies that had a longstanding interest in VET. The City & Guilds, for example, commissioned the report *How to teach vocational education: a theory of vocational pedagogy* (Lucas, Spencer and Claxton, 2012). Taking a very different starting point from the CAVTL Report, Lucas, Spencer and Claxton worked backwards from a literature review, web search and interviews with practitioners and sector experts to: (i) identify the characteristics of vocational learners and their teachers; (ii) understand the contexts in

which vocational education is provide; and (iii) offer an overview of effective vocational teaching and learning methods.

Like many before it, the report starts with a consideration of terminology including the scope of vocational education, and contains definitions frequently drawn from academic sources throughout. For example, the authors draw on the work of Watkins and Mortimore (1999) and define Pedagogy as:

The science, art, and craft of teaching. Pedagogy also fundamentally includes the decisions which are taken in the creation of the broader learning culture in which the teaching takes place, and the values which inform all interactions.

Although this appears to be an appropriate overarching definition of pedagogy for vocational education and training, the definition bears the imprint of its original source of inspiration: ideas about teaching in academically focussed educational institutions. Developing the argument that vocational learning and teaching is distinctive whilst relying on research and ideas more broadly from academic education means the report struggles to identify what is particularly specific to any form of work-based learning or why vocational pedagogy is different from academic pedagogy.

The report from Lucas and colleagues does acknowledge, however, that although 'what works' is frequently cited as the criteria for determining good vocational pedagogy, there is still insufficient understanding of the relative effectiveness of teaching methods in vocational education, and that that greater understanding will lead to more effective learning and achievement. To help vocational teachers take the best possible decisions in their classrooms, workshops, studios and training rooms, the report proposes a five stage process of developing a vocational pedagogy. The steps are:

- Be clear about the goal of vocational education;
- Understand the nature of the subject;
- Breadth of desired outcomes of vocational education;
- Understand the range of learning methods that may be blended;
- Vocational Education Context and the nature of learners.

The same writers in a report for the Edge Foundation (Lucas and Claxton, 2013) probed the issues from another angle, concluding that Shulman's (2005) idea about a 'signature pedagogy' may be a useful way to clarify what is distinctive about vocational as opposed to academic pedagogy. To do so, Lucas and Claxton firstly, focus on what they refer to as the medium through which vocational work is expressed. This leads them to maintain that vocational work involves teachers and learners working with: physical materials, for example, plumbing, people, for example, retail and care industries, and symbols, for example, accountancy and graphic design. Secondly, recommend that vocational teachers start by considering whether certain subjects suggest a particular method, for example, use of lectures to teach the principles underpinning accountancy. Thirdly, supplement this approach by recommending that vocational teachers employ a range of methods to assist learners to blend learning by listening, doing and reflecting.

Following a similar path to Lucas and Claxton, the report that Faraday, Overton and Cooper (2011) wrote to promote was also concerned to promote more effective teaching and learning in vocational education. The report acknowledged recent improvements in provision, however, it also noted that Ofsted (2010) has recently observed that the delivery of vocational education and training was variable in quality. Too much teaching and learning was mediocre and more emphasis was required on meeting individuals' needs through more suitable teaching methods. Faraday and colleagues initially reviewed the literature that explored the quality of vocational teaching and learning and what was effective teaching and learning in the vocational context. It included studies that identified which factors had the greatest effect on improving learner attainment and an overview of learning theories and teaching models. It then reinforced this approach by using a framework that encompassed four different elements of effective teaching – *Teaching Skills, Teaching Relationships, Teacher Reflection and Teaching Models* (Hopkins, 2007) – that originated in secondary education to examine examples of vocational teaching and learning in eight Further Education Colleges (FECs) identified as outstanding by Ofsted.

To avoid the lack of clarity and interchangeable use of terminology in discussions of learning and teaching, the report used its own definitions of each of the essential components in the framework and concluded that the following factors made the difference to high quality of vocational learning and teaching. They were:

- Teaching relationships – teachers’ commitments to their learners, the relationships they develop with their learners and range of roles that teachers take;
- Teaching models – are prescribed structured sequences, which are designed to elicit a particular type of thinking or responses, to achieve specific learning outcomes;
- Teaching strategies – are the ‘tools for teaching and learning’ that teachers have available to them and ‘teaching skills’ are the ways in which teachers select and use the ‘tools’ at their disposal to achieve effective learning;
- Teacher reflection – is a threefold process comprising direct experience, analysis of beliefs, values or knowledge about that experience, and consideration of the options which should lead to action as a result of the analysis
- Teaching context – covers a mixture of aspects and includes the nature of the vocational subject, the setting where teaching and learning takes place, objectives and desired outcomes for a session plus specifications of the qualification, the nature of the learners, their level and how they learn best including their learning styles.

Despite the very different approach adopted by the CAVTL (focus on learning and teaching for work) compared with the Lucas and Claxton and Faraday *et al.* reports (focus on vocational learning and teaching), all three reports have all been received un-problematically in the education and training sector. This is probably because they are written in a reader-friendly style and clearly reflect a very good appreciation of practical learning and teaching issues, which as other have noted are critical to high quality vocational education and training (Unwin and Huddleston, 2012). This concern can, however, sometimes result in vocational teachers understandably adhering to ‘yesterday’s best practice’ and, in the process, rather than considering whether the work context they are preparing their students to enter has changed, whether this development has any implications for vocational curricula and pedagogic practice and how to relate vocational pedagogy to workplace practice (Lahiff, forthcoming).

This possibility has recently been discussed in a number of reports from transnational bodies the European Commission, and the OECD and, in the case of SET, the New Engineering Foundation (NEF). The first report was produced as a response to the European VET strategy up to 2020 which called for “an active policy to enhance the potential of VET to support smart and sustainable growth, and to turn VET across the EU into a highly attractive learning choice”. A major focus for the report is why there is significant variation in the

enrolment, attractiveness and quality of VET between Member States. Hidden in the depths of this policy report is, however, the identification of a number of issues that foster a more forward-looking perspective on VET, from systems level down to the individual. Notable inclusions are:

- fostering work-based learning (WBL) and cooperation between VET institutions and enterprises;
- and, partnerships for creativity and innovation as well as effective use of innovative technology in VET.

The former is affirmed for its value in facilitating youth employment and increasing economic competitiveness, with the proviso that this depends on cooperation between VET providers and enterprises, though the report has less to say on how to engender or enhance such cooperation. The latter is affirmed as a way to prepare young people more imaginatively for work in the European knowledge economy. The report draws attention to the value of creativity and innovation competitions, as well as skills competitions, as strategies to enhance learners' skill development and, arguably, create the human capital conditions to stimulate innovation inside companies in the future.

A similar theme runs through review *vocational education and training, learning for jobs* published by the OECD (2011). Echoing arguments from the EC report about the actual and potential of VET for learners, the review proposes a number of reforms, several of which were pedagogically-focused, to re-connect learning and jobs in a world of change and career flux through the development of transferrable vocational skills. In particular, the review argues that all vet systems need to take full advantage of workplace learning. The review acknowledges that most vocational programmes involve some element of workplace learning, although sometimes this component is small or even non-existent, and that workplaces provide a strong learning environment, developing hard skills on modern equipment, and soft skills through real world experience of teamwork, communication and negotiation. It then introduces a caveat: for high quality vocational learning and teaching to occur it is necessary for vet teachers and trainers need to be familiar with the modern workplace, and industry trainers need to be equipped with appropriate pedagogical (and other) skills to supervise trainees or students learning in

the workplace. The review stops short of discussing how to familiarise vet teachers and trainers with the modern workplaces or to develop industry trainers' pedagogic skills. It does though acknowledge that the quality control of workplace learning is important and may be best tackled through contractual arrangements that set out the rights and obligations of trainee and employer or work placement learner and employer, inspections, self-evaluation and effective assessment of the skills acquired through training.

Finally, the new engineering federation (NEF) published a paper on the theme, of what they referred to as, '*t-shaped learning*'. The report argues that firstly, the following principles should be used to redesign existing vocational curricula and rethink existing vocational pedagogy:

- An atmosphere in which learners (of all ages) can think and create;
- An ambition to stretch the capabilities of all and which responds to all types of intelligence, understanding how deep learning happens;
- A teaching and learning strategy that encourages ingenuity and sees classes as 'theatres of opportunity' and utilises new technologies effectively;
- A curriculum that is based on delivering technical skills, attributes and capacity to apply knowledge and linked closely to work and industry;
- An assessment regime that records these things through accreditation and demonstrations of knowledge, skills and behaviours;
- A self-assessment approach to quality and relevance, driving innovation.

Secondly, assessment methods should be used that facilitate the development of 'deep learning' in colleges and workplaces by encouraging learners to demonstrate how they have applied knowledge to new situations.

4.4. Vocational pedagogy: conceptions and questions

One of the primary sources of inspiration for much of the research on vocational learning and pedagogy over the last twenty years is Jean Lave and Etienne Wenger's book *Situated Learning* (1991). This book was predicated on the idea that: people learnt occupational knowledge and skill via apprenticeship in work settings long before national systems of

education or vocational education were established; this continues to be the case; and that there could be considerable benefits from identifying how apprenticeship serves as a model of learning. It also introduced a number of concepts, for example, “situated learning”, “participation” and “community of practice” which have entered the vocational teaching and learning lexicon as researchers: (i) initially recognised that they constituted a new conceptual framework that could be used to analyse all forms of workplace learning and, in doing so, were a considerable advance on sociological concepts such as, socialisation and enculturation, which up to that point had been used to analyse workplace learning (Guile and Young, 1998); and (ii) subsequently modified or extended them in various ways to define the purpose, process and outcome of vocational learning (see *ipso facto*. Akkermann and Bakker, 2012; Billett, 2003; Fuller and Unwin, 2013; Griffiths and Guile 2004).

The title of the CAVTL report *It's All About Work* can therefore be seen as a contemporary recasting and updating of Lave and Wenger's idea about the goal of apprenticeship as membership of an occupational community of practice to encapsulate the goal for the diversity of forms of VET that exist in England, for example, generic VET as preparation for work (i.e. BTECs) and occupationally-specific VET (i.e. apprenticeship) as entry to work. Moreover, the report also affirms the importance of supporting learners' transitions – in its terms “operating in more than one setting” – between different situated contexts (i.e. educational institutions and workplaces), via its concern for opportunities for learners to receive feedback from “dual professionals”, wherever possible, as well as their teachers about their learning and skill development.

There are however a number of insights about vocational pedagogy contained in the work mentioned above that modified or extended Lave and Wenger's ideas that deserve sustained attention in this report, because they have introduced conceptual frameworks to understand different aspects of vocational pedagogy. To illustrate why, and also how they provide different insights into vocational pedagogy for SET that emerges from the grey literature, we now review the differences and connections between four very influential contributions to discussion about vocational pedagogy.

Workplace pedagogic practices

Drawing on a series of studies examining learning through everyday work activities (i.e. roles and tasks) and guided learning (i.e. coaching, modelling) in the workplace including their contribution and limitations, which were strongly influenced by Lave and Wenger's work, Billett (2002) advances a number of bases for understanding workplace pedagogic practices, in his terms, the ways in which people at work learn their occupational expertise. The core of Billett's argument is that whether referring to the activities and interactions arising through work or intentional guided learning at work, the quality and likely contributions of these learning experiences are underpinned by workplace participatory practices. These practices comprise the reciprocal process of how workplaces afford participation, in other words, provide explicit opportunities for workers to develop their knowledge and skill, and how individuals elect to engage with the work practice, termed 'co-participation'. In staging what might appear to be the obvious, Billett is in fact making a very important point: workplace experiences are not informal as is assumed by the much of the research (Marswick) and policy literature (EU) on workplace learning or VET. Workplaces are a product of the historical-cultural practices and situational factors that constitute the particular occupational practice, for example, civil engineering, electrical engineering mechanical engineering, and the interplay between a company's management and occupational practices distribute opportunities for participation to individuals or cohorts of individuals. That is, the opportunities for participation shape the conduct of work and learning through these practices and the development of vocational identity, which for Billett and others (Aarkrog, 2005; de Bruijn and Leeman, 2011) is the starting point for vocational learning. For Billett, it is the way in which individuals construe what is afforded by the workplace that shapes how they elect to engage in that practice and learn. As a consequence, he follows Lave and Wenger and sees no separation between engaging in conscious thought - such as when participating in socially derived activities and interactions - and learning. From this perspective, learning is conceptualised as an inter-psychological process of participation in workplace social practices such as, electrical engineering, hairdressing, plumbing etc., rather than being reserved as a term for activities and interactions intentionally organised to facilitate study (e.g. those in educational institutions). This broader definition of learning allows us to appreciate that while the outcome of studying in an educational institution is the

acquisition of a qualification, which denotes the disciplinary knowledge someone has acquired, the outcome of working is the acquisition of occupationally-specific knowledge and skill.

The process of co-participation, arises for Billett, as a result of the interplay between the affordances individuals perceive in workplaces, for example, opportunities to ask questions, observe aspects of vocational practice, and the way in which they exercise their agency to engage with those affordances. Billett therefore treats co-participation as a platform to build an understanding of workplace pedagogic practices. This includes understanding the contributions of learning through everyday work activities and the use of intentional workplace learning strategies, such as guided workplace learning (e.g. modelling, coaching, questioning, etc.). Billett advances a scheme comprising of two dimensions - activities and interdependencies (see below) – to highlight the interplay between these workplace activity and pedagogy.

Figure 1: Learning Through Work

(Workplace Pedagogic Practices: Co-participation and Learning, British Journal of Educational Studies, copyright © Society for Educational Studies, reprinted by permission of Taylor & Francis Ltd.)

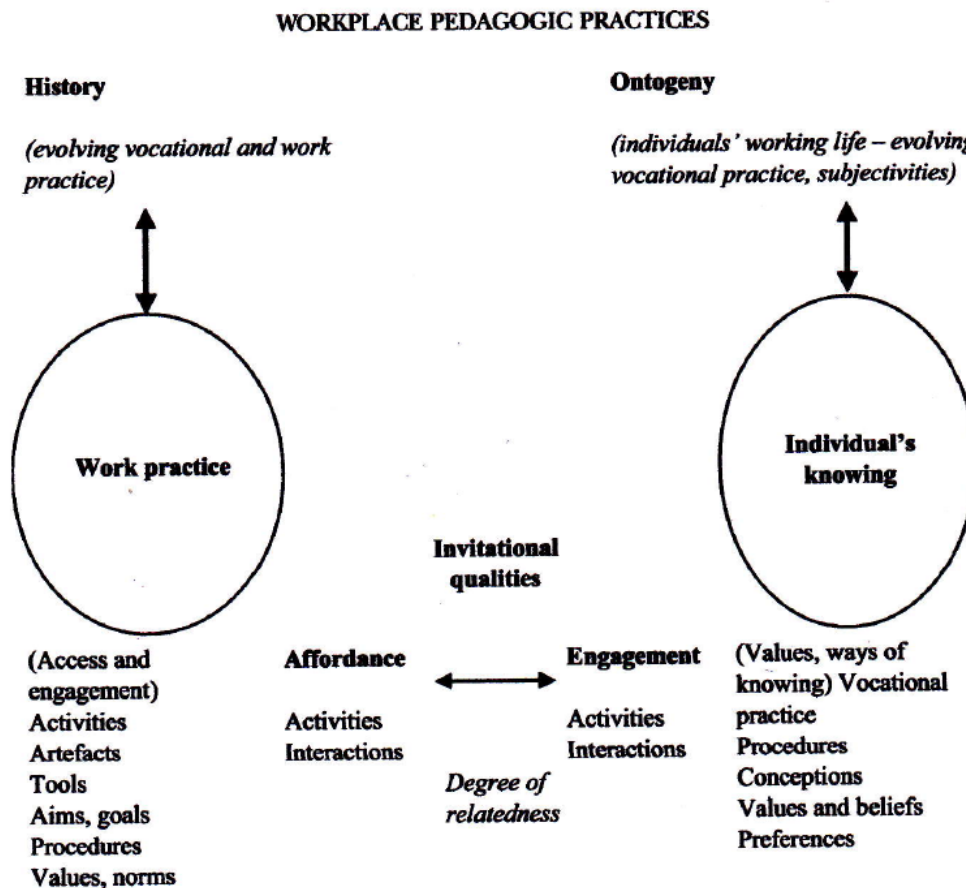


Figure 1. Co-participation at Work (Billett 2001c)

Billett’s scheme allows us to see therefore the taken for granted or hidden pedagogic practices that exist in various ways in most workplaces and that support people with employed status to learn in workplaces.

The pedagogic dimensions of work experience/placements

Drawing on Lave and Wenger and other sources, Griffiths and Guile (2004) in contrast to, but not in conflict with, Billett focus on the pedagogic dimension of work experience and work placements (the terms are used interchangeably) in vocational (as defined by CAVTL) and general education (i.e. work experience as part of academic courses) in the European knowledge economy. This means that although they engage with Billett’s focus on workplace participatory practices (modelling, coaching etc.), they are more concerned

with a discussion of the educational participatory practices which facilitate learners making the transition into their work experience/placement and back into college.

To do so, Griffiths and Guile construct a typology of work experience/placements, and identify four practices of learning that assist learners to “connect” theoretical and practical learning. The typology, which is presented below, is predicated on two interconnected arguments: that the purpose of work experience, which is negotiated between educational institutions and employers, and the assumptions about learning and development that exist in both contexts, influence the design, delivery and outcome of the work experience/placement. The following criteria, which underpin their typology, were derived from a five-country comparative European research project and is predicated on modularisation as the principle that underpins the design of curricula. They are:

- the purpose of work experience;
- the assumptions about learning and development (i.e. ideas about pedagogy and learning in workplaces);
- the practice of work experience (i.e. the types of practice which facilitate learning through work experience);
- the management of the work experience;
- the role of education and training provider (i.e. pedagogic strategies employed in vocational and general education to support learners);
- the outcome of work experience (i.e. forms of knowledge, skills or broader capabilities learners have developed).

Figure 2: Models of Work Experience

(Learning Through Work Experience, David Guile & Toni Griffiths, *Journal of Education and Work*, copyright © Philosophy of Education Society of Australasia, reprinted by permission of Taylor & Francis Ltd.)

MODEL OF WORK EXPERIENCE	Traditional Model 1	Experiential Model 2	Generic Model 3	Work Process Model 4	Connective Model 5
Purpose of work experience	'Launch' into work	'Co-development' between education and work	Key skill/competence assessment	'Attunement' to work environment	'Reflexivity'
Assumption about learning and development	Adaption	Adaption and self-awareness	Self-management	Adjust and transfer	Vertical and horizontal development
Practice of work experience	Managing tasks and instructions	Managing contributions PLUS - recording experiences	Managing action plan and learning outcomes PLUS - managing situations	Managing work processes, relationships and customers PLUS - adding value for employer - supporting employability	Developing the connective practices PLUS 'entrepreneurialability'
Management of work experience	Supervision	Arms-length supervision	Facilitation	Coaching	Developing and resituating learning
Outcome of work experience	Skill acquisition Knowledge of 'work readiness'	Economic and industrial awareness	Assessed learning outcomes	System thinking	Polycontextual and connective skills
Role of education and training provider	<i>Provide:</i> formal preparation programme	<i>Facilitate:</i> briefing for and debriefing of work experience	<i>Build:</i> portfolio of achievements	<i>Support:</i> reflection-in and on-action	<i>Develop</i> partnerships with workplaces to create; environments for learning

No specific work experience programme is likely to fit neatly into any of the models and some work experience programmes may contain elements of more than one model.

The four practices of learning, which were derived from debates in learning theory in the late 1990s and early 2000s, are the development of: (a) “theoretical thinking”, that is, the ability to use the concepts, conventions and procedures associated with different disciplines as a resource to engage with occupationally-specific practice and problems; (b) “dialogic inquiry”, that is, the ability to ask questions to more experienced others in the contexts of education and work, irrespective of their role (teacher, supervisor, fellow worker etc.) to understand how to perform discipline or occupationally-specific tasks and how to tackle discipline or occupationally-specific problems; (c) “boundary crossing”, that is, the ability to operate effectively in the contexts of education and work; and (d) “resituation”, that is, the ability to modifying ways of thinking, asking questions, deploying technical skills according to the need of the situation rather than in accordance with habituated practice.

The clearest way to illustrate Griffiths and Guile’s (2004) argument about how the relationship between the practices of learning and the purpose of work experience generate different outcomes is to contrast the outcomes associated with two different models of work experience. To illustrate this point, we have taken the generic and connective models.

The generic model, which was developed in the UK from the mid-90s onwards is an attempt to use work experience to acquire and accredit pre-set learning outcomes in the form of key skills, assumes that learning is a process of self-management. In other words, learners use opportunities presented to them or negotiate opportunities to engage in activities that will enable them to assemble evidence that they have acquired, or at a minimum, practiced certain skills. This model treats workplaces as a fairly unproblematic site of learning and development and, in the process, glosses over Billett’s (2003) very nuanced argument about the contribution that co-participation, guided learning etc. play in facilitating or inhibiting learning in workplaces, and treats learners as ‘acquirers’ of evidence. In doing so, the model avoids acknowledging any of the four practices of learning.

In contrast, the connective model is an explicit attempt to articulate the relationship between the learning that occurs in the context of education and work. It defines learning in the former as a process of vertical development, in other words, grasping the relationship between the theoretical concepts which constitute the content of the educational programme someone is studying, for example, engineering, IT, science etc., whereas learning in workplace is defined as a process of horizontal development, in other words, developing the capability to appreciate how concepts that have been taught in educational contexts are embedded in work practices and routines, for example, using theoretical thinking as a resource to interpret computer generated data in a factory or laboratory, and developing occupational competence by engaging in dialogic inquiry to facilitate participation in occupational practices and routines to deliver a product or service.

This suggests that there is a two-fold pedagogic challenge: educational institutions have to prepare learners before they undertake their placement for the likely differences between college/provider and workplace cultures, and also remind them that their course content is unlikely to manifest itself in the form in which they have learnt it in education; and workplaces have to assist learners to participate swiftly in occupational practices and routines and encourage learners to 'see' the ways in which the concepts they have learnt are manifest in those practices and routines. The hallmark of this pedagogic challenge is, as Griffiths and Guile (2004), point out is the use of briefing and debriefing sessions. Both however tend to focus more on *cultural* (i.e. workplace expectations) and less on *conceptual* (the way in which disciplinary concepts are embedded in work routines and artefacts) preparation and rarely involve any employer input. For this reason, Griffiths and Guile conclude that the most effective work experiences/placements are characterised by educational institutions and workplaces establishing partnerships based on a shared understanding of the purpose, process, and outcome of work experience, and its value to both partners.

The extent to which briefing is a sufficient strategy to facilitate learner participation has been examined closely by a number of writers. Lindberg (2003) distinguishes between three ways in which teachers can develop learners' ability to think theoretically and in the process support them to develop practical competence. The three ways are: *school tasks* (i.e. learning the principles underpinning and relationships between concepts and their

potential relevance to practical activity, for example, food ingredients and dietary conditions); *simulation tasks* (i.e. learning to represent one system to another one, for example, using drawings to understand the operation of a CNC machine); and *vocational tasks* (i.e. learning to produce a product or service, for example, repairing a boiler). Lindberg acknowledges that modularisation facilitates this diversity of curriculum design. Furthermore, she points out that these three tasks generate very different demands on learners' literacy use and development in different vocational programmes in her sample, for example, the technical programmes industrial and electrical engineering seemed to demand more complex reading compared with the retail programmes, because the former required learners to read scientific texts and manuals, which presupposes prior knowledge of different scientific concepts, whereas the latter required learners to read nutritional articles and recipes, which are informed by different scientific concepts but whose meaning can nevertheless be apprehended without having a 'deep' scientific knowledge. This difference reflects the requirements of each vocation, but depending on learners' level of literacy it places different demands on teachers supporting them to develop the ability to think theoretically and engage in dialogic inquiry. Lindberg concludes with an extremely interesting observation: that teachers are, despite the diversity of task, still inclined to use the 'social practice' of their institution, in other words, assisting learners to read texts to support factual recall rather than practical application.

Using slightly different language – authentic rather than simulation and vocational – Wesselink *et al.* (2010) explore the issue of teachers using school practices to prepare learners to undertake a work placement. They argue that this problem can be minimised if: a) teachers and workplace supervisors modify their traditional role and operate as coaches to encourage learners to reflect on different aspects of the work experience; and b) learners accept greater responsibility for managing their learning by planning their learning activities. Wesselink *et al.* argue that, in the case of the former, teachers and workplace supervisors need to visit their respective workplaces so they develop knowledge of one another's occupational and pedagogic practices. This boundary crossing will help them to support learners to not only reflect on the development of their theoretical and occupational competence, but also assist them to see why 'learning by doing' in the workplace does not in itself prepare them for the academic aspect of their learning: it facilitates learning an occupational task but not understanding of which forms

of knowledge are embedded in that task and therefore makes it difficult to write about the practice-theory relationship.

Workplace environments and their pedagogic dimensions

The argument that workplace environments offer workers diverse forms of participation that, in turn, foster learning at work was taken a step forward when Fuller and Unwin (2004) coined the distinction between “expansive” and “restrictive” learning environments, and employed that distinction to identify difference ways in which the Level 3 Advanced Apprenticeship Programme can be organised by employers and experienced by apprentices. Drawing inspiration, like Billett, from Lave and Wenger, Fuller and Unwin firstly, offered a very nuanced definition of the concept of participation to encapsulate the active nature of learning in the context of education (i.e. participate in the practice of mathematics or physics). Secondly, they extended the concept of community of practice so it could refer to the role of the educational community that learners were using as a resource to assist them to eventually become a member of a specific occupational community, for example, apprentice mechanics use the staff and student members of their college/provider to help them to understand the principles of motor mechanics and, in the process, develop the capability and confidence to operate more effectively in the occupational community of practice (i.e. motor mechanics) they will join in the workplace.

To understand why and how apprentices struggled with the above forms of participation, Fuller and Unwin distinguished approaches to workforce development according to their ‘expansive’ or ‘restrictive’ features to highlight the opportunities and barriers to learning. Their list (see over the page) is not intended to be exhaustive but represents an attempt to bring the factors (pedagogical, organizational and cultural) that contribute to workforce development and the creation of a learning environment, into a single conceptual framework. The cornerstone of the framework is the way in which it recognises that: (i) the way work is organised, jobs are designed and skills are treated influences the extent to which apprentices encounter opportunities or barriers to learning in workplaces; and (ii) the configuration of learning in educational institutions and workplaces and qualification options influences the opportunities that apprentices have to progress at work or onto higher educational programmes of study.

Figure 3: Expansive-Restrictive Framework: Approaches to Apprenticeship

(Learning as Apprenticeship in Contemporary UK Workplaces: Creating and Managing Expansive and Restrictive Apprenticeships, Alison Fuller & Lorna Unwin, Journal of Education and Work, reprinted by permission of Taylor & Francis Ltd, www.tandfonline.com.)

EXPANSIVE	RESTRICTIVE
Apprenticeship develops occupational expertise to a standard recognised by industry	Apprenticeship develops skills for a limited job role
Employer and provider understand that Apprenticeship is a platform for career progression and occupational registration	Apprenticeship doesn't build the capacity to progress beyond present job role
Apprentice has dual status as learner and employee: explicit recognition of, and support for, apprentice as learner	Status as employee dominates: limited recognition of, and support for, apprentice as learner
Apprentice makes a gradual transition to productive worker and is stretched to develop expertise in their occupational field	Fast transition to productive worker with limited knowledge of occupational field
Apprentice is treated as a member of an occupational community with access to the community's rules, history, occupational knowledge and practical expertise	Apprentice treated as extra pair of hands who only needs access to limited knowledge and skills to perform job
Apprentice participates in different communities of practice inside and outside the workplace	Training restricted to narrowly-defined job role and work station
Apprentice's work tasks and training mapped onto the occupational standard and assessment requirements to ensure they become fully competent	Weak relationship between workplace tasks, the occupational standard and assessment procedures
Apprentice gains qualifications that have labour market currency and support progression to next level (career and/or education)	Apprentice doesn't have the opportunity to gain valuable and portable qualifications
Off-the-job training includes time for reflection and stretches apprentice to reach their full potential	Supporting individual apprentice to fulfil their potential is not seen as a priority
Apprentice's existing skills and knowledge recognised and valued and used as platform for new learning	Apprentice is regarded as a 'blank sheet' or 'empty vessel'
Apprentice's progress closely monitored and involves regular constructive feedback from range of employer and provider personnel who take a holistic approach	Apprentice's progress monitored for job performance with limited developmental feedback

Whilst recognising that apprentices' own biographies and dispositions, in other words, their motivation and styles of learning, are a significant influence on their participation in workplace practice, Fuller and Unwin argue that workplaces are characterised by different cultures and modes of participation in those cultures and that these constitute vocational pedagogy in the workplace. Their argument can be illustrated through considering the following two examples of participation in: a community of practice that has a "shared participatory memory"; and "multiple communities of practice" inside and outside the workplace. The critical issue is, in the case of the former, for experienced members of the workforce to assist newcomers to understand why and how knowledge and skill have changed by relaying and updating 'war stories', that is, explaining what used to work, what works now, and what is not working as well now as it used to; and, in the case of the latter, for educational institutions and workplaces to a) rotate apprentices work roles to enable them to gain insights into how different workplace activities relate to one another, b) allocate apprentices opportunities to participate in 'routine' and 'stretching' activities in the workplace and vocational classrooms/workshops to enable them to appreciate what challenges lie ahead of them, and c) provide apprentices with opportunities to reflect on both types of their situated learning. By this Fuller and Unwin mean, concepts that constitute some of the underpinning knowledge for a specific work practice, for example, the concept of a chemical compound, is learnt abstractly in vocational classrooms in terms of its structure, its bonds and so forth, may be referred to when apprentices examine artefacts such as, a steel girders in vocational construction workshops, but is, all too often, rendered opaque in workplace settings, for example, when considering the infrastructure of a building.

One vocational pedagogic challenge is for lecturers and workplace supervisors to encourage apprentices to use their membership of both the academic and occupational community of practice to ask questions and to receive answers about the relationship between the content of their study and the practical tasks they undertake in workplaces. The issue of learners asking questions and receiving explanations from vocational tutors or workplace supervisors is complex and has been explored by Fillietaz *et al.* (2010) through reference to the notion of "analogical discourse". By this they mean, using analogies to assist learners to link existing' to emerging understanding via the notions of "source" and "target" knowledge. Taking the example from the construction industry of

the way in which steel is hardened, Fillietaz *et al.* show how a trainer uses the analogy of ‘as brittle as ice’ to assist a group of apprentices to understand that after the annealing process steel remains easily breakable unless it is cooled off in a process known as quench hardening. The trainer initially focuses the apprentices’ attention on the chemical structure of metal which allows it to harden (target knowledge) before referring to ice (as a source of everyday reference) and the brittleness of ice (linking process) to ensure the apprentices understand why metal rods are strong.

Fillietaz *et al.* conclude that firstly the source, target and link constitute three elements of a referential organisation of analogical discourse and as apprentices grasp their relationship to one another they develop the capability to use analogies to ‘ratify’ their understanding, to ‘contest’ explanations that have been put to them, and ‘recycle’ them in other situations. Secondly, analogies are recurrent, albeit under appreciated, pattern of vocational learning and teaching and that by making their role more explicit it may be possible to enhance vocational pedagogy.

Another challenge is to supplement vocational teachers’ expertise in the delivery of vocational programmes with the expertise that an occupational expert can provide, to assist learners to appreciate the relationship between their vocational studies and the deployment of knowledge and skill in their chosen occupational field. This process of supplementation has, as we saw earlier, been described by the CAVTL Report as “dual professionalism”, in other words, securing the service of an occupational expert to ‘teach’ their practice. The case studies of dual professionalism that are currently being produced have not yet been published as academic articles and can only be found on the Teach Too web page – *insert link*. An insight into the type of benefits that the use of occupational experts can make to the delivery of vocational programmes is, however, provided by Fuller and Unwin’s discussion of companies’ use of external trainers or assessment/verifiers to assist apprentices to consolidate their knowledge and skills. Fuller and Unwin note that some companies use staff from training providers, who have been contracted to teach apprentices particular skills or who are reviewing apprentices’ progress towards the mandatory qualification requirements, to help apprentices to grasp the relationship between occupational skill and practice and the underpinning knowledge they have been taught or expected to learn as part of their own self-directed efforts.

Both challenges, are according to Fuller and Unwin, accomplished more easily and more comprehensively in an expansive environment where, amongst other factors, time is given over to helping apprentices or learners on work placements make those connections, but this type of understanding is severely curtailed in restrictive environments.

Boundary crossing and vocational pedagogy

The relationship between the concept of boundary crossing, which has surfaced in the two preceding discussions of vocational pedagogy, and learning has been fully explored by Akkerman and Bakker (2011). Their starting point is the idea that all boundaries, for example, between education and work, one occupational specialism and another etc., constitute both a potential learning resource and an opportunity to offer some form of assessment of that learning. From this perspective, VET has always been concerned with the forms of learning that occurs as people cross boundaries. Nevertheless despite this historic feature of vocational education, the focus of much research, prior to VET researchers using the concept of boundary crossing to focus on the learning potential of boundary crossing, fell on learning in colleges or workplaces and assessment learning in either of those contexts (see the series *The International Handbook of Technical and Vocational Education and Training* for example (<http://www.springer.com/us/book/9781402083464>)).

The increasing interest in boundary crossing and the associated concept of boundary objects reflects a possible new horizon in educational theory in general as much as in vocational education in specific: first, because this literature focuses explicitly on boundaries between disciplines or occupational communities rather than on them in isolation from one another (Tuomi-Gröhn, & Y. Engeström, 2003), and second, because the claim that boundaries constitute a potential learning resource rather than a barrier is a paradigmatic definition of vocational education and training (Akkerman and Bakker, 2011). The net result has been that the concept of 'boundary-crossing' has been used to advance knowledge and understanding of vocational pedagogy and they ways the learners acquire and use their knowledge and skills across different contexts and settings. The empirical settings for this research has spanned across degree-level vocational education (Konkola, Tuomi-Gröhn, Lambert, and Ludvigsen 2007; Lutters, W. G., & Ackerman (2007); Melles, G. (2008); Paay, J., Sterling, L., Vetere, F., Howard, S., & Boettcher, A. (2009), and there have also been some extremely interesting

studies of statistics in SET programmes at below degree level (Akkermann and Bakker, 2012; Tanggaard, 2007; Williams and Wake).

In their review article Akkerman and Bakker (2011) argue in contradistinction to other vocational education researchers that dialogue between people, rather than imitation or studied observation, is the most important resource for facilitating learning (see Billett 2014 for the most recent exposition of the latter argument). Akkerman and Bakker (2011) identify four dialogical learning mechanisms that they distilled from the literature on boundary crossing – ‘identification’, ‘coordination’, ‘reflection’, and ‘transformation’ – and indicate specific characteristics of each of these mechanisms.

The first term refers to where a process in which lines of demarcation between practices which have historically been treated as separate and different from one another, even though they had a relationship to one another, are experienced by people moving between them as ambiguous or destabilizing yet nevertheless generate new opportunities for learning. An interesting illustration of this issue is provided by Tanggaard (2007). He notes that many colleges have used Schon’s (1987) notion of a “practicum”, that is, an attempt to match vocational curricula and pedagogy to occupational requirements, in an attempt to prepare learners to move un-problematically from a college to a work placement. He explores the type of problem associated with this attempt to make the college environment ‘authentic’ to assist learner transition to the workplace via the notion of “identity”. Tanggaard argues once learners join a workplace they swiftly embrace the occupational identity they encounter because it helps them to know, what to talk about, how to think about work practice etc. As a consequence, learners are initially inclined to initially devalue the subjects they have been taught in college because they are unable to see how to ‘apply’ them in workplaces. However, learners gradually come to realise that one reason they often struggle with complex tasks is because they do not understand the knowledge base that underpins them. When this happens learners are prepared to accept that they have to develop a way to ‘combine and modify’ their learning in both contexts if they are to develop their higher-level practical competence.

One reason that learners struggle to combine and modify their learning is that many vocational teachers report that they perceive a ‘gap’ between college-based and work-based learning (Baartman and Kilbrink, 2014). In an attempt to find a way to overcome that gap vocational

teachers have, for some time, asked learners to keep a diary or log of their workplace successes and frustrations so these can be discussed retrospectively in colleges (Stenström and Tynjälä, 2009). The issue of how students combine or integrate the various types of knowledge developed in college or the workplace is gradually attracting more attention from researchers. One ongoing study is being conducted Heusdens, Baartman and de Bruijn (2014). Their preliminary results show that learners “contextualize” (i.e. see the relation between these different types of knowledge) and “conceptualise”, that is, infer what follows theoretically or practically best when they experience a moment of breakdown. Heusdens and colleges define these moments as “*oops-* and/or *aha-*moments”, by this they mean respectively, a moment of confusion or incapacity to act (not knowing what to do), and a moment of sudden realization, inspiration, insight, recognition, or comprehension. They are currently exploring which pedagogic strategies best facilitate the promotion of such moments in colleges and workplaces since they tend to occur as part of a learners’ private deliberations or reflection-in-action and are therefore less available as a resource to collectively consolidate learning.

The second learning mechanism “coordination” refers to the means and procedures which allow diverse work practices to coalesce effectively in a distributed pattern of work (i.e. where people working on the same activity are stretched across more than one setting). This issue has been highlighted by, for example, Lutters and Ackerman (2007), in their case study of service engineers by showing how engineers use sketches to coordinate consensus amongst all parties working together, including apprentices, about how to interpret the performance of engineering systems and this consensus constitutes a situated judgement about how to proceed. From the perspective of boundary crossing, the critical issue is that if boundary objects, in this case sketches, are to facilitate learning then they have to become a shared resource so that all parties contributing to an occupationally-specific activity can use a boundary object to grasp the explanations that different members of a team have advanced, ask further questions to clarify why they made that suggestion, and using the object as an aide de memoire at a later point in time to consolidate their understanding. The skills involved in boundary crossing are therefore multi-dimensional and complex, and the challenge for learners is to identify similarities and differences between different contexts (Sappa and Aprea, 2014). The diversity of ‘boundary crossing skills’ and the ways in which colleges can contribute

to this process of learner development is still under investigation by vocational researchers (Sappa and Aprea, 2014).

The term “reflection” refers to people coming to realize and explicate differences between practices and thus to learn something new about their own and other practices. Williams and Wake (2007), for example, describe how, as college teachers, they visited workplaces together with their students to make the latter aware of the differences between both college and work culture, so students found it easier to ask questions in both contexts to support their learning. They observe:

On reflection, we therefore come to see our own mathematical genre [within academic college and research] as one which has its own conventions and rules. We argue that this should be a significant aim in pre-vocational mathematics education: coming to understand how the school mathematics is a particular, historically and culturally situated one... We would argue that a pre-vocational curriculum should teach about workplace diversity as such a multi-cultural mathematics. (p. 340)

Thus Williams and Wake anticipated by several years the current emphasis policy on the contextualisation of mathematics in vocational education policy (*insert ETF web link*). For them, the critical issue was for mathematical educators to introduce learners to the history and diversity of mathematical concepts, procedures etc. to provide a disciplinary contextualisation of those concepts. Post the CAVTL Report, one important development has been to involve occupational experts in the design and delivery of mathematics in vocational programmes (Guile, Derrick and Grainger, 2014). The intention is to make mathematical concepts visible through introducing them via their manifestations in work practice, artefacts etc. so learners can discriminate more accurately between the work practice and the mode of mathematics incorporated within it. For example, vocational learners on work placements in a hospital laboratory often refer to their work as chemistry, even though to model chemical reaction processes they were using extrapolation, slope and other mathematical concepts.

The fourth “transformation” refers to using reflection to generate new understandings about the diverse practices that intersect between the contexts of education and work. Akkermann and Bakker (2012) provide an excellent example of this learning mechanism from their own research. Focusing on learners moving from college to scientific or technical laboratories, they introduce a conceptualisation of workplaces that is missing from most other research on boundary crossing: workplaces as *technologically-mediated*; *scripted*; and *social*. By this they mean

the work process relies extensively on technology, most commonly computers, standard operating ways of proceeding and reporting results, and the involvement of several parties to confirm results and determine the next course of action, and taken in combination this makes work *opaque* (i.e. learners struggle to see any relationship between their college-based maths or science) and *distributed* (i.e. collective deliberation is the norm).

Akkermann and Bakker supplement Tangaard's use of the concept of identity to explore and explain learning with the concept 'epistemic culture' (Knorr Cetina, 1999). They use the former concept to explain that learners' developed their occupational competence in the laboratories because they were given 'normal' rather than 'invented' work tasks, and this enabled them to 'see' themselves as a legitimate member of the occupational community and feel able to ask more experienced staff questions when they were unsure about how to interpret a computerised result. They use the concept of epistemic culture to probe an issue Tangaard acknowledged but left under-addressed: the combining of college and work-based learning. Akkermann and Bakker are able to do so because they interviewed learners and observed them in college and in workplaces. The former allows them to observe that:

Whereas students' questions [in their post-workplace debriefs] were mostly directed at specifics of workplaces [why scripts, how to interpret computerised data], teachers' questions mostly addressed disciplinary issues underlying the work [presentations of their experiences] that students gave (Akkermann and Bakker, 2012, p. 165).

In contrast, workplace supervisors observed that:

Apprentices in laboratories are responsible for reporting results and making preliminary interpretations, but these are always checked by others... because there is too much at stake to leave it to a single lab technician, and this includes apprentices (p. 161.)

Akkermann and Bakker conclude that there are two epistemic cultures in play: the academic one which is based on teachers endeavouring to ascertain whether learners have understood the mathematical, chemical or biological aspects of the work; and the workplace one which stresses that 'correct' answers are implicit in workplaces' 'socio-technical systems' and thus exceed 'the cognition of any individual lab technician'. Furthermore, Akkermann and Bakker argue that the best way for teachers to assist learners to overcome the apparent difference

between these two epistemic cultures is by 'opening the black box of work'. They recommend that teachers should during debriefings focus on 'framing' questions to:

- Help learners to see the way in which the concepts they have learnt in chemistry, biology etc. are embedded in workplace routines and artefacts, rather than trying to test learners' ability to match concepts to aspects of work;
- Encourage learners to provide examples of the type of 'scripted' discussions with a range of people they were involved with in workplaces to assist teachers to appreciate the ways in which concepts from chemistry, biology etc. they are teaching learners are embedded in workplace routines and artefacts and used as resources to resolve problems.

One issue that is missing from much of the literature on boundary crossing is the role of ICT as a resource to support learning across contexts (Ludvigsen *et al.* 2011). The expansion of digital technologies provides learners with opportunities to access and undertake learning activities in a range of other settings, including home, college and workplace environments, public libraries and youth centres. Felstead and Jewson (2012) observe that the recent developments in information technology have weakened the spatial fix, with workers and learners becoming increasingly detached from personal cubes of space, thus facilitating crossing boundaries between different contexts. The use of devices such as computers, laptops, mobile phones and netbooks has contributed to the development of the virtual learning space where learning might not be associated with a specific site or specific time. The virtual learning environment provides a degree of flexibility for the learner, enabling them to acquire learning at a time and place convenient for them. The use of new technologies and mobile learning has been gradually changing approaches to and ways of teaching and learning within the context of vocational education and training.

The potential of digital or mobile technologies for VET has recently been explored by Wishart and Green (2011) through their notion of 'scenarios' for the future. Based on discussions with colleges from Further Education or involved with work-based learning in Higher Education, they identify a number of ways in which learners could use ICT, specifically mobile technologies, to facilitate boundary crossing. Three interesting scenarios, because they are at present realisable, are:

- *Working and learning together on placements* – handhelds or mobile laptops could be used by learners to share their experiences, reflections with their peers and tutors whilst they are on placement, which would enable learners working on the same or similar problems to liaise with one another and discuss how they were tackling the same problem, and tutors could organise Skype discussions between themselves and learners on placements to discuss converging and diverging experiences.
- *Recording experiential learning in a vocational area* – colleges could ensure that learners create their own portfolios, which could be accessed by mobile phones, via an Internet café etc., while learners are studying with them. This resource would have both a private and public space: the latter would contain a learners' photographs, videos, video diary reflections of occupationally-specific learning while the former would contain their course materials, assignments and assessments, via a VLE, and so forth. The former would enable learners, at a later date, to use aspects of their experiential learning for peer discussions, a resource for assignments, and for inclusion as part of their shared professional portfolio in public networks such as, LinkedIn.
- *Connecting services and resources* – colleges, in conjunction with their libraries, can arrange for learners to have remote access to books, periodicals, databases etc. which can be accessed whilst studying away from colleges or on work placement. In the case of the latter, this would enable learners to revisit course content while on placement and try to use it as a resource to open the workplace black box and/or to post questions that others on work placement or their tutor could answer.

Mobile learning is therefore not simply about delivering content to mobile devices but, instead, about the processes of coming to know and being able to operate successfully in and across new and ever-changing contexts, learning spaces and boundaries (Pachler et al (2011)). Aspects of this issue is currently being pursued by Cattaneo and colleagues (2015) by looking at the role of technology-enhanced journal systems to facilitate learner boundary crossing with taught and simulated elements of vocational programmes as a resource to support the boundary crossing between college and work placements.

4.5. Vocational knowledge: conceptions and questions

In parallel to the discussion of the concept of vocational pedagogy, there has also been a discussion of the concept of vocational knowledge (see *inter alia*. Wheelahan, 2012; Young 2007; Young and Gamble 2006). Writers contributing to this discussion are concerned that the focus on vocational pedagogy deflects researchers, policymakers and practitioners' attention from a number of very complex issues about the character of vocational knowledge and this, in turn, has serious implications for both the design of vocational curricula and student progression from lower to higher programmes of study.

The gist of the argument the above writers make about what is distinctive about vocational knowledge can be expressed as follows. Vocational curricula consist of courses that are based on diverse forms of disciplinary and occupational knowledge. In the case of SET, some forms of knowledge are derived from 'singular' disciplines (Biology, Chemistry, Physics) or 'regions' based on combination of disciplines (Bio-Chemistry), others from work practice, and others from Health and Safety legislation. These forms of knowledge are, however, based on very different principles. Drawing on Bernstein (2000), Wheelahan (2011) and Young (2007) argue that disciplines are characterised by "vertical knowledge discourses", in other words, hierarchically organised bodies of knowledge with their own specialised languages, procedures etc. These languages provide criteria which disciplinary specialists use to relate concepts to one another in the same discipline when constructing curricula based on single disciplines, for example, Biology, Chemistry, or inter-disciplines, for example, Bio-Chemistry.

The situation becomes slightly more complicated in SET programmes. This is because these types of programmes are based on regions, for example, engineering is based on concepts from mathematics and physics and from the inter-disciplinary field of engineering science, as well as concepts and practices from occupational practice and this field varies according to engineering specialism (i.e. mechanical or electrical). The latter are, according to Wheelahan and Young, based on "horizontal knowledge discourses", in other words, bodies of knowledge where concepts have a heterogeneous relationship with one another. This leaves vocational lecturers with a number of conundrums: do they first teach the disciplinary concepts which underpin a region such as engineering science, and then introduce the inter-disciplinary concepts or do they teach them inter-

changeably? This conundrum is further compounded by the fact that SET courses also involve aspects of work practice that are skill-based such as, using CAD software to design different type of system, and teaching learners to follow Health and Safety procedures to ensure they can operate technologies effectively and safely in workplaces. This forces teachers to consider the extent to which skill-based elements of a vocational curriculum are taught alongside or after learners have been introduced to disciplinary concepts.

The problem with an exclusive focus on vocational pedagogy is, according to Wheelahan and Young (*ibid*), that critically important questions about how to: a) “classify”, that is, assist learners to appreciate the difference between concepts emerging from disciplines that are singulars compared to regions and the difference between those type of concepts and occupational concepts; and b) “frame”, that is, decide which pedagogic strategies, for example, lecture, DVD simulation, workshop activity etc. should be used to introduce different types of concepts to learners and also in which order this introductory process should occur.

This is an extremely important issue. It can lead, however, to an interpretation of the aim of vocational pedagogy as assisting learners to ‘apply’ theory to practice. This is however, as the previous section of the report, highlighted a conception of the role of vocational pedagogy that should be avoided. We identify ways to address the theory-practice and practice-theory relation throughout the next section of the report.

4.6. Review of vocational learning and teaching: implications for case study methodology

A number of different but complementary insights emerge from this circumscribed review of the research and grey literature on vocational learning and teaching. Moreover, these insights when taken together, as we shall see, can be used to create a methodological framework for the case studies of SET.

The cross cutting insight that emerges from both literatures is that vocational pedagogy is different from academic pedagogy because it serves a dual purpose: to prepare someone with the occupationally-relevant or occupationally-related knowledge and skill to make the transition to employment (clear line of sight to work) and to succeed with the academic elements of their programme of study. Where they differ from one another is that the research literature provides a number of conceptual insights as regards how to think about the design and delivery of vocational learning and teaching, whereas the grey literature tends to concentrate on identifying and/or affirming the value of specific aspects of learning and teaching, for example, differentiated tasks, work experience, assessment etc.

From our perspective there are firstly, five main issues that emerge from the research literature that are relevant to our case study investigation of SET which are relevant to excellent vocational learning and teaching. They are the extent to which colleges:

- combine theoretical and practical knowledge and skill in contextually-relevant and differentiated ways vocational curricula;
- use modularisation as strategy to achieve their preferred pattern of combination and contextualisation;
- organise work experience and/or apprenticeship to assist learners to appreciate the connection between theory and practice and to offer them as wide a range of options as possible in colleges and workplaces to develop their knowledge and skill;
- support learners to move between college and work in a range of ways, including face to face and the deployment of new technologies;
- support learners to: (i) participate in workplaces cultures that can facilitate or inhibit learning; and (ii) appreciate the way in which theory is embedded in practice and that practice involves the use of tools and other people as resources to develop occupationally required knowledge and skill.

The main issues emerging from the grey literature are the extent to which colleges:

- make clear to learners the purpose and potential employment and academic outcome of different vocational programmes;

- deploy a wide repertoire of learning and teaching styles to assist learners to develop knowledge and skill;
- adopt a broad definition of competence to reflect its academic and employment dimensions;
- use employer contributions to vocational programmes to support the process of contextualising knowledge and skill in occupationally-specific or relevant ways;
- use methods of formative and summative assessment to assist learners to appreciate the knowledge and skill they have developed, and still need to, develop.

There is however one further issue that is relevant to our case study investigation, which has not appeared in either the grey or research literature. That issue is the history that informs the selection of SET programmes within a college. The reason why any organisation became involved with a particular activity has long been recognised in the case study literature as having an extremely important bearing on an activity's design and delivery (Stake, 2000; Yin, 2002). For this reason, each case study will start with a brief history of why a college became involved with a SET area, how it sees that area developing in the medium term, and the ways in which vocational learning and teaching are organised to support the overarching college goal. It will then focus on selected aspects of a college's approach to learning and teaching. Moreover, in common with the CAVTL Report, our report has also used the criterion of OFSTED Grade 1 to assist us to identify and select colleges for inclusion in the report. We have also followed the British Education Research Association Ethical Guidelines and anonymised the colleges.

5. Case Studies

5.1. Hillside College

The context: teaching and learning arrangements

Engineering provision at Hillside College is long-established and has been delivered and facilitated through the collaborative work and commitment of the engineering department staff. The engineering department has made a firm commitment to sustaining excellence in the delivery of engineering courses. Providing high quality learning experiences for the students is considered to be the top priority for engineering department staff. The college attaches great importance to the significance and substantial rewards of engineering provision for their learners, which opens for them a range of exciting career opportunities that exist at many levels in the engineering sector.

The engineering profession has always supported and facilitated high quality and exciting vocational routes for young people, opening for them a range of career opportunities. And here in the college, we do everything we can to help the young people to enhance their career chances and lifelong opportunities. [Curriculum team leader, Engineering].

While recognising that the industry is currently experiencing a skills gap the college emphasises that there is a wealth of opportunity available for those who gain high-quality skills in these areas:

Engineering graduates are employable and high in demand! According to the recent statistics more than 60 % (nationally) were in full-time employment within six months of graduating from their course. [Curriculum team leader, Engineering].

Examples of career opportunities include: Engineer, Vehicle Repair Engineer, Metallurgist, Electronics Engineer and Auto CAD Designer. The courses lead directly to employment or on to Higher Education.

The philosophy that underpins engineering provision in the college is based on a strong conviction that engineering teaching and learning should combine both theoretical and practical skills, and that meaningful consolidation of the former and the latter results in high-quality training within the field. One of the most distinctive characteristics of engineering

provision in the college is its strong and continuous collaboration with a range of stakeholders, such as Hillside Colleges Group and City Training Services. City Training Services have over 30 years' experience in helping young people in apprenticeship programmes and providing an extensive range of apprenticeships in different areas including engineering. The cooperation the college with a range of providers and partners is characterised by a 'working as a team' approach, which facilitates both sustainability of excellence in engineering provision and continuous development and innovations in teaching and learning strategies within the college and the workplace. The college prides itself in having been selected, through a tender, as a preferred supplier for Northern Power Grid, which is the largest distribution network operation in the North of England region, delivering electricity to 3.8 million domestic and business customers.

The college offers a wide range of engineering courses, including full-time and part-time courses, as well as high-quality engineering apprenticeships. Working with different awarding bodies (such as City and Guilds, Pearson, IMI, the department aims to provide a stimulating and encouraging environment for learners. The college's pass rates for Further Education courses are above the national average. For courses of more than 24 weeks' duration, the pass rates are 93% compared to 91% nationally and for courses of less than 24 weeks duration, they are 96% compared to 92% nationally. The college curricula and pedagogic strategies are strongly based on the principles of contextualising theoretical knowledge within practical activities, which leads to developing links between college and workplace and ensuring and further facilitating employers' engagement.

Engineering Courses available in the college

The college offers a wide range of engineering courses at Level 3. Through courses such as the Electrical and Electronic Engineering Extended Diploma Level 3, Electrical Installation City & Guilds 2365 - Level 3 and the Level 3 apprenticeship, learners are given valuable experience and learn skills that can be applied in the Engineering sector. The courses offer both full-time and part-time training opportunities, and full-time courses at Level 3 have the highest number of students.

Enhancing learning through boundary crossing, tailoring and contextualisation

The notion of contextualisation, in its various configurations, is regarded as a significant element of curricula and pedagogic strategies. Responding to employers' needs through continuous cooperation, and adapting the college's training programme to the requirements of local industry are perceived as significant aspects of contextualising college-based training within the broader context of the workplace in the field of Engineering.

Boundary crossing and tailoring are the key concepts that permeate vocational pedagogy within the department. Strategic approaches associated with these concepts are primarily driven by the needs of employers and those of local industry:

We are trying to deliver, within the boundaries of a specific qualification, what employers want. It is increasingly clear that interaction with employers is extremely important! It could be facilitated through careers talks, career workshops, mock interviews, work experience and placements. [Curriculum team leader, Engineering]

Engineering department staff attributes the success of their provision to promoting and sustaining close cooperation between the college, employers and other stakeholders. As noted by one of the tutors:

We attach great importance to work experience. A lack of general workplace experience among is one of the most significant possible limitations for job-seekers applying for engineering jobs. There is a clear need for young people to develop their understanding and gain some experience of the day-to-day demands of the contemporary workplace. [College practitioner]

In developing the qualifications, the college cooperates closely with the awarding bodies, the National Skills Academy for Power and the Energy & Utility Skills Group

The curriculum [for Levels 1–3] is co-developed through City and Guilds as the awarding body, the National Skills Academy for Power and the Energy & Utility Skills Group (Sector Skills Council). They originally put together test specifications for what the qualification should hold at the appropriate level, and from that the assessment methodology was put into place to ensure that it was all achieved. Working in conjunction with employers we are actually developing qualifications, which they believe

are fit for purpose and respond to the requirements of the industry. [Curriculum team leader, Engineering]

The department sees its mission as part of a continuous exploration of new opportunities to develop their cooperation with a range of stakeholders specifically aiming to facilitate employers' support and engagement. Engineering department staff (tutors and curriculum leaders) specifically aim:

- To raise awareness about engineering and what engineers do among students and parents;
- To motivate young people about engineering and the career opportunities available in this field;
- To encourage young people to make career choices and subject choices that keep open the routes into a career in engineering.

An example of a successful initiative is achieving the status of a preferred supplier of the Northern Power Grid in 2009 (for Levels 2, 3 and 4 qualifications). As a result of this arrangement, since 2009 the department has had 122 apprentices with the Northern Power Grid, with a 100% success rate.

Theory–practice consolidation

Practical work in the college is a significant element of training provision and delivery. The department is equipped with a number of modern workshops, which aim to provide a taste of a authenticate workplace environment for learners. The balance between practical and theoretical teaching/learning varies; however, the programme manager noted that typically it would range from 50/50 to 40/60. A good mix of theoretical and practical aspects is regarded as high on the department's agenda.

One of the most significant characteristics of the apprenticeships programme is that it is employer demand-led. At the same time, for young people, apprenticeships are real jobs with training. [Curriculum team leader, engineering].

The apprenticeship programme, undertaken in collaboration with local employers, provides a good example of the way the college facilitates the consolidation of theory and practice through boundary crossing within the context of their course delivery:

We regard and promote apprenticeship as a form of vocational training and learning where learners work alongside professionally qualified staff to acquire both job-specific and general skills and receive on- and off-the-job training. Learners get skills and competences that enable them to facilitate their career development. Apprentices spend a lot of time with their employer, acquiring and developing job-specific skills, – usually 3-4 days per week. [Curriculum team leader, engineering]

Apprentices (at Level 3) spend one day a week in the college, where they engage in learning activities, taking both core and optional modules. Apprentices are assigned a Training coordinator/Assessor who support them from day one and for the duration of their apprenticeship, they will visit them every 10 weeks to review their progress and will be available to speak to them at any time should they need to.

Maths is one of the core modules that is considered to be of critical importance in the context of engineering provision. The college has a strong commitment to delivering the core modules through continuous demonstration of the relevance of their content to the world of work. Embedding theoretical knowledge in the context of practical activities is regarded as one of the significant approaches across the departments. Projects involve a lot of communication – for example, students need to understand diagrams, Health and Safety issues and Electrical and Electronic principles.

Demonstrating the relevance of theoretical knowledge to practical activities is achieved by tailoring the delivery of the college modules to the requirements of the workplace, which, for the college, means the needs of local employers. The college believes strongly that this helps to make the delivery of theoretical knowledge meaningful and relevant to real-life practical activities. Optional modules are dictated by local industries:

They would come to us and say: 'We would like to have a Micro Control unit included,' so we would include it to respond to their needs. We have to cover all the core units, as dictated by the Awarding body, but we can tailor our optional modules delivery to the needs of the local employers and those of the learners. [Section head / Curriculum team leader, Engineering]

Theory–practice consolidation is further facilitated through a range of teaching strategies. Most of the lecture rooms are designed in such a way as to enable both teaching theory and applying theoretical knowledge in practice:

The lecture rooms are both classrooms and workshops! This enables our students to see how what they have learnt could be applied in practice. [Section head / Curriculum team leader, Engineering]

The balance between theory and practice is dictated by specific module content; however, even for theory-based modules (e.g. Principles of Electronic Engineering), the tutors aim to contextualise theoretical knowledge by relating it to possible practical activities. The ‘Project’ module (final module) provides excellent opportunities for the contextualisation and consolidation between theory and practice. Within this module students undertake their own project that combines both theoretical and practical activities and in which they need to bring together what they’ve learnt in other modules, and to integrate their knowledge within relevant practical activities. The students are strongly encouraged to demonstrate the relevance of their theoretical knowledge to the world of work.

Practice in work placements: embedding theoretical knowledge and practical skills into the world of work

The significance of providing students with opportunities to undertake work experience has been emphasised as one of the priorities of the engineering department. Specifically, as noted by the programme manager (Engineering), the department team attaches great importance to providing opportunities for work experience for full-time students. In order to achieve this, the college collaborates with local employers, and as a result of this collaboration the students are able to spend some time engaging with a work-related environment. Typically, work experiences would constitute 30–40 hours over a course of study:

The courses are theoretical; the work experience enables them [the students] to feel what the industry is like: to see an industry-related environment. And this opens their eyes when they come to the college.

After their work experience, the students would often tell their tutors: ‘Oh, now I understand why you are pushing us to do Maths!’ They can see how it’s relevant to the real workplace. [Programme Manager, Engineering].

Embarking on work experience with local employers would often open further opportunities for learners. The department encourages further (post-work experience) opportunities and learner–employer links:

Very often, after a compulsory period of work experience a learner would be invited [by the employer] to come back for further experience, or to become an apprentice. We encourage this, and we are very pleased to see the development of mutual trust and cooperation between the learner and the employer as a result of work experience. [Programme Manager, Engineering].

Facilitating the links between learners and employers is regarded as one of the most significant priorities for the Engineering Department. The tutors consider it their responsibility to provide meaningful advice and guidance to the learners on how to get the most from their work experience. The tutors emphasise that work experience presents the learners with continuous opportunities to engage in a range of work-related activities that demonstrate the ways that theoretical knowledge (what they learn in the college) could be applied in practical activities.

For the field of Engineering, work experience is invaluable. The learners can't master their profession properly without trying out what they have learnt in the college in practical activities within the workplace. Within their work experience they can also get a proper understanding, real-life understanding of Health and Safety issues. What we learn in the college is important, what they could get from their work experience is equally important, and I think that all of them should get the chance to get involved. [Tutor, Engineering]

At the same time, as the interviews indicated, learners' work experience is considered to be a mutually beneficial exercise, i.e. there are benefits for all parties involved: for the learners, employers and the college. Interviews with company representatives have indicated that inviting the learners to undertake some work experience within the workplace could lead to a range of benefits for employers:

By inviting young people to spend some time with us, we promote our company and our industry. Aspiring businesses should always look for good people. Some of our current employees are close to their retirement, and we would like to get a glimpse of what young people who could come and work for us are like. Work experience is an ideal opportunity for this. We can see if we like a young lad (or a lass), and he can see if he likes us and the way we do things here. [Employer's interview]

The benefits for the college, such as developing links with employers, have been cited by both the tutors and the department curriculum team leaders. The students who are given the opportunities 'to taste what the real work is like' are more motivated and more positive towards learning and skills acquisition in the college. As tutors noted, within their work

experience, the learners can contextualise their academic knowledge in practical activities, and this provides a scope for further learning and competence development.

Enhancing teaching and learning arrangements through tailoring to local industry needs

The college makes a strong commitment to tailoring what they deliver to local community needs. The ‘working as a team approach’ enables the college to respond to local needs in good time. This is achieved through continuous collaboration and ‘keeping in touch’ with locally based industries.

We aim to deliver what our local employers want. For example, we have a company which manufactures transformers and a lot of transformer panels. To respond to their needs we have modules that would be based on doing ‘wiring’, so the modules would be picked out to meet their needs. [Tutor, Engineering]

In practice, keeping in touch with local employers is achieved through various initiatives and approaches, such as engagement employer forums and open days. The college makes its firm commitment to developing links and cooperation with local business in order to get a better understanding of the needs of local businesses. Taking part in a range of national and local events provides many opportunities to liaise and develop cooperation with employers. Events, such as National Apprenticeship Week, Employers’ forums and conferences, and College Open days, contribute to facilitating employers–college links and engagements. Specifically, such occasions increase awareness of local industry needs on one side, and what the college can offer to local businesses, on the other. As a result, learners receive up-to-date training, information and guidance, which ultimately enhance their chances in the labour market. Visiting local employers and identifying their needs and requirements is considered to be another important strategy.

I have recently visited one company, and they mentioned that all their senior members were reaching the stage of retirement. So they wanted more and more involvement with us, so we could supply students to fill the places. The demographic situation in the Engineering cohort provides opportunities for recruitment. [College practitioner]

The final module ‘(Project)’ provides an excellent opportunity to contextualise what has been learnt in the college and tailor this to the needs of local industry. Students are encouraged to develop their own projects taking into account the requirements of local employers. Success stories include employers’ interest in students’ projects and using the project’s results within their companies.

Enhancing teaching and learning arrangements through tailoring them to learners' needs

The college encourages learner-centred approaches by providing a range of opportunities for learners to undertake activities that aim to uncover their potential and facilitate their potential and professional development. Engineering department staff provides excellent support for learners, in particular, stressing that central to everything is excellent and highly commended teaching, potentially small class sizes and easy access to your academic tutors:

Our student-centred focus means that that our students will always be more than 'a face in a crowd'. Whatever advice the students need on academic, career or personal matters, there is always someone they can turn to quickly, easily and with confidence [Programme manager, Engineering].

The college specifically emphasised the role of new technologies, and the ways they're employed to facilitate the development of students' problem-solving skills. A Virtual Learning Environment (VLE) is employed to provide the students with resources for further learning and development:

After their lectures, the students would go online, like a VLE, to get further insight into the problem we discussed in the class. The VLE would refer to websites where they could learn a bit more. [Curriculum team leader, Engineering]

Learner-centred approaches also relate to facilitating students' pathways and progression, helping to move the full-time students into apprenticeship.

What the students want is employment, and we are doing our best to make them employable, by giving them the skills and knowledge that employers want, in the first place. But also we are trying to get them into employment, by putting them in touch with employers, so they could start an apprenticeship. Full-time students are really keen to become apprentices. [Course tutor, Engineering].

All students have opportunities (and are encouraged) to take part in regional, national and international competitions and a range of unique events/projects. Such activities and initiatives enhance learners' motivations and positive attitudes towards learning and skills acquisition. One example of good practice is Matchfit competition, which provides a series of vocational skills competitions open to students aged 16 and over who are studying a vocational subject at levels 1-3. Competitions are available in a variety of subjects, including engineering. Education providers from across the region host the competitions. The programme aims (1) to inspire and continuously enhance the skills of students and employees, (2) to uncover their potential, and (3) to bring their talents to the surface. The competitions include both

theoretical knowledge tests and hands-on activities. Matchfit competition aims to empower students, thus contributing to developing learner-centred approaches within the department and the colleges.

In addition, as part of its learner-centred approaches, the college provides *Additional Learning Support* to learners with a range of disabilities and special needs. There are five Support Teams and extra specialists. There is also a Well-being Advisor for learners with mental health needs. The Assistive Technology Team advises on specialist hardware and software and can provide loans of equipment. The college aims to help the learners to become as independent as possible and achieve success at College.

College–employer links and partnerships

Looking to and responding to the needs of local employers has been high on the agenda of the Engineering department. College–employer links and partnerships are considered to be a vital element of engineering training provision in Hillside College. The distinctive feature of the development and sustaining of links with local employers is in the close collaboration within Hillside Colleges Group and City Training Services (CTS), which is a wholly owned subsidiary company of Hillside College. Created in 1983, CTS has a track record of several decades of helping young people in apprenticeship programmes in the Yorkshire area. Apprenticeships offered by City Training Services provide opportunities for 'on-the-job' training for the practical aspects of the apprenticeship and 'off-the-job' teaching and learning, on the day release or block release basis, for the theoretical aspects in the college. CTS provides engineering training for work-based learners (apprentices). The provision includes mechanical, welding and fabrication, and electrical engineering. Colleges (such as Hillside College) are subcontracted to deliver technical certificates. Engineering staff include a manager, internal verifier and four assessors/coordinators. All learners are employed. CTS has a broad base of employer companies within its areas of provision and provides apprenticeship and advanced apprenticeship opportunities in several subject areas, including Engineering. The department collaborates with approximately 40–50 employers. CTS takes responsibility for making the initial contact with employers and developing further cooperation. As noted by the engineering curricula leader, the benefits of employer engagement and collaboration are enormous. The collaboration with Northern Power Grid resulted in the successful apprenticeship scheme, and other collaborative initiatives:

We work collaboratively with them [Northern Power Grid]. They actually provided the college with quite a lot of resources that we would not have been able to acquire without them, for example, different insulators and cables for practical demonstrations. So the learners can see them in real life – not only in their textbooks or on computer screens! It's important for them to see the real size and scale of what they are looking at! [Curriculum leader, engineering].

Employers take an active part in collaborating with the college, specifically through inviting their representatives to a range of events (such as Health and Safety conferences and employer-led events and activities). This helps the college to be up-to-date with industry developments and contemporary innovations, thus enabling them to transfer this knowledge in the college setting within the engineering provision. In addition, employers have organised training courses for college staff. Both the college and employers believe that meaningful engineering provision is achieved through continuous collaboration and knowledge sharing between parties. Cooperation with local companies (including small- and medium-sized enterprises) makes the delivery of apprenticeship programmes a joint and cooperative initiative.

Employers' engagement is becoming stronger and stronger. It has not always been like this. I think nowadays there is a lot of competition in the market and we have to work collaboratively if we want good results. Everybody understands it now. And by everybody I mean employers, learners, college and other stakeholders. [Tutor, Engineering]

Strong employer engagement is demonstrated by their own initiatives in facilitating collaboration with the college. As noted by a local employer, they value the collaboration with the college, and this provides opportunities to develop really meaningful joint programmes and schemes:

If we work together collaboratively, it means that we get what we want, and what we need for our workplace. We have apprentices, and their success in the workplace and in the college is a product of our cooperation with the college. [Local employer]

Assessment strategies: towards collaboration with employers

Assessing learners is delivered through both formative and summative assessments. Summative assessments (for example, from BTEC) is considered to be highly prescriptive, with little room for flexibility:

BTEC gives us grading criteria. We are given a little measure of latitude to make it locally based. Generally we use these criteria and put together a task, but we have to follow these criteria. It's not a question of giving us a syllabus so we could pick and mix. They tell us what we need to test. [Curriculum leader, engineering].

With formative assessments the college has a higher degree of flexibility, and the students are continuously formatively assessed and provided with feedback throughout their time in the college. Continuous assessment of their performance is carried out by means of assignments, homework, class and laboratory work, including a range of practical activities. The college employs a range of strategies and approaches to make different forms of assessment meaningful for the students (e.g. through relating it to practical activities). Demonstrating the relevance of theoretical knowledge to the world of work is considered to be an important part of the assessment. Facilitating employers' engagement is regarded as another important development that ensures the quality and excellence of the provision:

More and more we are trying to interest and involve local employers in becoming part of the assessment. And they respond! We would talk to them – what do you think the grade should be? And we discuss. And they would give their perspective on what needs to be improved [Curriculum team leader, Engineering].

Involvement of employers in formative assessment and provision of feedback to students is also a significant trend in assessment strategies. This is an important development that facilitates both provision of valuable feedback from local employers for the learners and cooperation between the college and industry.

5.2. Millside College

The context: teaching and learning arrangements

The provision of engineering teaching and learning at Millside College is continuously developing and has received much recognition from learners, employers and the community. The commitment and enthusiasm of the engineering department staff have facilitated many

initiatives and projects in the area of engineering delivery both in the college and in the workplace. The collaboration with local businesses is regarded as a fundamental element of the provision, and the college fully recognises the significance of the growth and development of local industries. Recent research commissioned by the BBC placed Millside top in Lancashire and second place in the North-West overall for the proportion of businesses with good growth prospects. Such promising prospects for further development of local industries open up excellent opportunities for the college to sustain and develop a range of collaborative activities with local businesses.

One of the significant features of the engineering provision in the college is its proven expertise and experience of Composites training delivery. Recognised by the Composites Skills Alliance as a successful training provider in Composites, Millside College takes pride in delivering a range of new initiatives and teaching and learning approaches in Composites training provision. One of the most distinctive features of this provision in the college is a combination of both responding to the needs of local industry and taking into account the requirements of Composites training provision in a broader national context. The engineering department staff attach great importance to developing collaborative projects with experts and practitioners involved with Composites industries (colleges and industries) both locally and nationally. The involvement of competent bodies such as the Composites Skills Alliance facilitates this process and provides opportunities for developing links and cooperation in the area of Composites training provision. The Composites Skills Alliance – a partnership of organisations led by the National Skills Academy Process Industries and Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies – plays a vital role in developing links and collaboration between Further Education (FE) colleges and employers. Sharing expertise among practitioners and experts working in Composites industries and training providers is considered to be of crucial importance.

The growing importance of Composite materials as an industry has been recognised by the college as a promising development that could contribute to the prosperity of the region and the local community. As noted by one of the college practitioners, the skills gap in the composites area, identified by employers, has been seen as critical for the future development of advanced manufacturing in the local area. Composite materials are widely used in the aerospace industry and are predicted to become even more ‘in demand’ as new materials and manufacturing processes are developed.

As noted by both employers and college practitioners, working with Composites is different from traditional engineering methods, and this specialism requires a highly complex understanding of the ways the materials actually work.

We're just going down the Composites routes. We are working with the Composites Skills Alliance who are acting under the National Skills Academy to undertake a project about the difficulties of establishing Composites provision. There is a need to develop specialism at a technician level. We entered in the agreements with them [Composites Skills Alliance] and we became one of five providers that sat on the academic side of things, and on the other side of the Composites Skills Alliance are the employers. They try to direct the Composites Skills Alliance, saying – this is the curriculum that we want! And we, with the other colleges, are working together trying to produce academic material. It was quite a joint effort. We had a lot of shared resources. [Curriculum manager, Engineering]

Employers similarly point out that the Composites specialism requires highly complex approaches in training and development:

This is the specialism that develops all the time! Practitioners and experts face a number of challenges when they set up courses. We need to look closely at what is happening in the sector both nationally and globally. [Local employer]

The college offers a wide range of courses in Composites, including BTEC, apprenticeships, higher education qualifications and short-term bespoke courses for specific employers, comprising both full-time and part-time courses. The full time Level 3 - BTEC Diploma in Engineering have the highest number students, although this may vary slightly from year to year.

Enhancing learning through boundary crossing, tailoring and contextualisation

Curricula and pedagogic strategies are strongly related to the notion of contextualising or embedding theoretical knowledge into practical activities. Making links between theory and practice has been prioritised by the teaching staff and has also been supported by employers who are collaborating with the college. Teaching methods that the tutors employ include a wide range and combination of approaches such as lectures, seminars, practical workshops, presentations, discussion groups, etc.

We may start a session with a discussion (on Composites) and then move to something more practical. So it would be a combination of both, it would depend on a specific topic and level. [College practitioner]

Curricula and pedagogic strategies are developed in order to respond to the needs of local industries. In shaping course curricula, the department takes into account the needs of local businesses. In developing course curricula, the college endeavours to involve employers, and to take into account their needs and perspectives. Representatives of local employers take part not only in developing the curriculum but also in delivering lectures, presentations and demonstrations for students within college settings:

It's really good [for the college]. But it's still down to the employers – giving their employees for a release for the morning, so they could come to us. But they actually see the benefits of that, because we give some publicity in the local press, about how wonderful it is [...]. [College practitioner]

Involving employers in curricula development and teaching and learning processes in the college contributes to boundary-crossing between learning in the college and practice in the workplace. Both the college and employers recognise the significance of this development and look into further opportunities to take these steps further.

Theory-practice consolidation

College practitioners strongly believe that the consolidation of theory and practice is a prerequisite that permeates engineering provision as a whole both in the college and beyond. Bringing together theoretical knowledge and practical experience is considered to be an important goal of college training courses. This is achieved through a range of initiatives, approaches and methods, such as (1) incorporating practice activities into theoretical teaching, and vice versa both within the college and in the workplace; (2) facilitating employer involvement; and (3) using modern technologies to cross the boundaries between the theory and practice.

The combination of theory and practice is a fundamental element of course delivery. Practical work in the college contributes to emphasising the links between theory and practice and making theoretical knowledge meaningful once it's applied and contextualised in practical

activities. Although there are separate teaching spaces for theoretical knowledge and practical activities, theory and practice is consolidated through teaching and learning activities:

We have got an area in the college all set up for teaching practical activities. Theory is taught in conventional classrooms. The practical bits in the workshop would be all practical with a small amount of theory and the theoretical teaching would be about theory but with a small amount of practice. [College practitioner]

Employer involvement in college-based teaching is a significant approach that contributes to the consolidation of theory and practice. Inviting representatives from local industry to deliver practical content (workshop-based teaching) within the college has become a fundamentally important element of engineering course provision. Employers who collaborate with the college maintain that bringing the right balance between theoretical knowledge and practical activities involves a joint effort of both college and industry:

We are very lucky with the college and the facilities that they have. When the learners go into the college [...] a lot of what learning would be based on is practical hands-on experience. [Local employer]

Modern technologies and mobile learning are being used for building the bridges between theory and practice and enhancing learners' experiences.

There is a big advantage for apprentices (in using the VLE, Virtual Learning Environment). After one year of their training they are not in the college that often any more, as they are with their employers. If they have the VLE they can access it outside the college; that makes things much easier for them – they are not really disadvantaged by not being here. [College practitioner]

A tutor further notes that students really value this flexible access to college resources, and this contributes to their motivation and learning success in the workplace.

Tailoring and contextualisation of practices in the college to the requirements of local industries have been realised through the development of tailor-made courses for specific businesses/employers. One example is the bespoke course *Manufacturing Excellence* (on Composites in the aircraft industry), put together at the request of one particular employer. It is a two-day dedicated hands-on course that takes place in the college workshops. The course content responds to the needs of the contemporary aircraft industry, in which about 40–50 per cent of the materials used are Composites. The course is intended for those already in the workplace, and the main objective of the course, as noted by the Curriculum manager (Millside College), is to boost the quality of performance in the workplace. This training gives an overview to materials science, composite materials, and engineering design and provides

opportunities to gaining some hands-on experience with the equipment used in the industry. This course is generally designed for those aiming to improve their knowledge within the area of composite materials and advanced materials technology. Such courses make it possible to embed the requirements of specific employers in college-based courses, thus contributing to the contextualisation of practice and boundary-crossing between the workplace and the college.

The engineering department strongly encourages its students to take on various opportunities for practical work experience and/or placements in the workplace. The Career Academies' national scheme provide students with help to apply for internships. Career Academies UK is a national charity that links schools and colleges with employers to help prepare young people for the world of work. Work experience is not compulsory (but is available to the students) and the students are encouraged to take part. Career Academies UK is a highly successful programme, which provides a structured scheme of internships, mentoring and workplace visits for 16–19 year olds. Generally, this scheme is designed to complement students' theoretical studies and to emphasise the links between theory and practice.

The college, and the engineering department in particular, prioritises the significance of equipping students with practical skills through engaging them in practical experience in the workplace. The department's industrial partners help to achieve this goal by providing opportunities for learners to engage in practical activities in the workplace.

Enhancing teaching and learning arrangements through tailoring to fit the needs of local industry and learners' needs

'It's really consultation with industry that got us where we are today', notes one of the college practitioners. The contacts with employers present a mixture of formally organised events (e.g. open evenings) and more informal meetings, consultations and discussions. In addition, apprenticeship schemes provide many opportunities for college–employer contact and collaboration.

We have got regular contact with employers. As well as apprentices coming to us [the college], we go to the workplace to see their work in the workplace. We meet with an apprentice and an employer at least once a month.

The department has made a firm commitment to listening to employer views and perspectives. Incorporating the requirements of local industry has become an underlying philosophy of the engineering department's teaching approach:

We developed a course specifically for one employer around what they asked us to deliver. The course content was around carbon fibres that are usually combined with other materials to form a composite. They actually put 200 people on this course. [Head of Curriculum, Engineering]

Facilitating learners' life chances, including employment and career opportunities, is recognised as an important objective within the college, and the engineering department, in particular. Learners' progression is encouraged and promoted by tutors, curriculum leaders and careers advisors. As noted by a college practitioner:

We consider ourselves to be very much a 'one-stop shop', and the learners are encouraged to undertake further learning, within either further or higher education.

What makes such learner-centred approaches even more successful is employer involvement, support and encouragement. Employers, in collaboration with the college, provide support for learners' aspirations and ambitions:

It will depend on the individual aspirations, because the vast majority are recruited to be airspace craft fitters at the end of their apprenticeship. Some of them, once they start, actually a high proportion of them, have aspirations of becoming Process Engineers or Process Managers. We have meetings with them and we talk about their aspirations. We always take into account their past work, their capabilities and what we need as a company. [Local employer]

Such joint (college–employer) endeavours to support learners' aspirations and progression enhance learners' motivation and individual learning successes in the college and beyond.

College–employer links and partnerships

College–employer links and partnerships have a long tradition within the college. The college practitioners prioritise employer involvement and adopt a range of approaches to generate and further develop employer interest and engagement:

We were hosting events getting our local employers on board. And they are interested, as they see the benefits of mutual cooperation! We are developing apprenticeship frameworks within Composites in collaboration with our local employers. [College practitioner]

The college has an Employers Advisory Board, where employers are invited to give their views and perspectives on what curricula they want the college to deliver:

We do the programme course review that involves the employers. [College practitioner]

The Engineering Curriculum manager emphasised the role of the Composites Skills Alliance, noting that in establishing links with employers it plays an important part and acts as an intermediary between FE colleges and employers. As a National Skills Academy they were liaising with employers and colleges at the national level, bringing together a full and comprehensive picture of Composites training needs across different regions. Millside College welcomed this opportunity to be involved in the national initiative that aims to facilitate cooperation not only between employers and colleges, but also between FE colleges across different regions:

We were listening to people from the South-West [and other regions], who were more into the marine side of things or motor vehicles, so we were working with these people, who all had different needs from their own [local] employers. So we try to standardise the apprenticeship curricula. [College practitioner]

Looking beyond their immediate workplace requirements is considered to be significant for broadening the outlook of students and equipping them with more general knowledge on Composites materials in contemporary industries:

Our students will have to understand the principles of Composites slightly outside their area of their expertise in their workplace. [We focus on Aeronautical Engineering]. There are different methods in handling Composites. So some of what they learn, they will not be using in the workplace around here, but they have to be aware of the requirements of the Composites industry as a whole. [Curriculum manager, engineering department]

It's very important that you get collaboration with the industry and therefore you get a bit of credibility with your employers and the people are aware that you have been in this position, and that you understand the nature of their business. It's not just learning for learning's sake. [College practitioner]

The success of college–employer collaboration is continually sustained and facilitated through apprenticeship schemes. The college collaborates with Themis (the Apprenticeship and business training division of Millside College). Themis is one of the largest Apprenticeship

providers in the area. They work with over 1,000 Apprentices and deliver Apprenticeships in over 40 subject areas and provide a host of business training solutions which deliver beneficial impact on business performance. In the field of engineering their apprenticeship and advanced apprenticeships programmes include, as follows:

- Aeronautical Engineering
- Composite Manufacturing
- Electrical / Electronic Engineering
- Engineering Maintenance
- Engineering Technical Services
- Engineering Tool Making
- Mechanical Manufacturing Engineering
- Welding and Fabrication

Employers and the college both consider apprenticeship training to be a joint initiative and effort and the concept of training partnerships is a notion that permeates cooperation between the college and employers. One example of a successful apprenticeship scheme has been reported by a local employer, one of the leading companies in the field of nacelle systems. The employer offers apprenticeships in aerospace fitting, which provides excellent career and developmental opportunities for the learners.

The collaborative activities of the employer on one hand and the college on the other make this scheme extremely rewarding and effective. It's a four-year programme and the learners spend most of their first year in the college, acquiring theoretical and specialist knowledge related to Composites. For the subsequent three years of their training, the learners are in the workplace, with a possibility of day release in the college. What makes this programme successful is a high degree of collaboration between the college and employers during the whole of the apprenticeship period:

When we take Composites apprentices, we are heavily involved and we helped to put the apprenticeship scheme together ... and the skills that the college teaches have been worked out with collaboration with us. We would work very closely with the college. [Local employer]

Apart from apprenticeship schemes, cooperation between the college and employers includes other training initiatives, such as opportunities for work experience for learners, Health and Safety training in the workplace, and developing bespoke courses for employers.

Other modes of collaboration, which are considered to be highly beneficial for employers, college and the local community as a whole, include organising joint events, such as Open Days. The employers' involvement and support are of crucial importance, and their continuous involvement is the main precondition for the successful cooperative initiatives. As noted by a local employer:

We do quite a lot with them: the apprenticeship recruitment, Open Evenings, the Career Academy; we are sponsoring an engineering award. I can't see this changing at all. [Local employer]

In addition, a major new building project to expand the education and training provision offered by Millside College has been taken forward with key assistance from employers and industry representatives. The project's main objective was to complete work on extra space for its Centre of Engineering Excellence and Construction Learning and Training Centre. Local employers have been providing crucial input into this initiative. The expansion of the Centre of Engineering Excellence will provide apprentices with the opportunity to train with the latest engineering technology, including:

- 13,000 sq ft. engineering training facility housed within Millside College campus
- New CAD/CAM suite with 3D Printing and Faro Arm with laser line scanning
- Composite materials clean-room, aircraft fitting and sheet-metal sections
- Additional CNC Machining and Turning Centres with Heidenhain CNC programming stations

This initiative, as well as other collaborative activities with local employers, address a 'skills shortage' in engineering, and growing demand for engineering training provision.

Collaboration and involvement of local employers and industrial partners have been considered instrumental in addressing a range of demands of a contemporary workplace.

Assessment strategies: towards collaboration with employers

Assessment strategies include a range of methods and approaches, such as observations of practical activities, witness testimony from employers, evidence an apprentice has produced,

and written assessment. Assessment approaches have been designed to promote the links between theory and practices between different modules.

For apprenticeships, assessment approaches represent a combination of college-based and work-based assessments. The technical certificate will be assessed in the college, whereas The NVQ will be assessed in the workplace. One distinctive feature of the assessment process relates to looking for ways to involve employers in the assessment. As noted by a college tutor:

With the NVQ I called for a particular employer to develop a test. They told me the standards they wanted their apprentices to reach, and I checked that it would fit with the NOS (National Occupational Standards), and we incorporated them into the assessment [Tutor, engineering].

Both employers and tutors strongly believe that assessment is an important element of engineer training provision. As noted by another college practitioner:

Assessment is part of this process [education and training]. An apprentice will need to demonstrate their competence through meaningful assessment. This is to ensure that the apprentice is ready to progress within their employment or further training [Tutor, Engineering].

Assessment strategies are continuously developing, in order to respond to the needs of local employers and take into account the requirements of Composites training provision in a broader national context.

5.3. Meadowside College

THE CONTEXT: TEACHING AND LEARNING ARRANGEMENTS

Meadowside College is a college of further education with 4,000 full-time and 11,000 part-time students covering mid- South East England. It has a turnover of approximately £49M delivered through two main campuses and a number of smaller centres. The College prides itself that outstanding Teaching and Learning is at the heart of what they do, and the College achieves consistently high success rates over and above the national average.

The College has a very strong vocational philosophy that permeates throughout the organisation. They see that they are preparing all their learners for the world of work or university, so employability and employability skills are absolutely key. All students undertake the Meadowside College Enterprise Passport, based on the seven key employability skills which the Confederation of British Industry identified in successful entrants to the workplace. “Positive about Futures”, the new careers service at Meadowside College, acts as the hub of all career advice and provides careers advice and information on available jobs to students using local market intelligence.

The college has set itself a number of strategic objectives, of which three are particularly relevant to this case study;

Strategic Objective 1:

Deliver outstanding teaching and learning which ensures the highest levels of success for our students

Strategic Objective 2:

Deliver vocational and academic education and training to students

Strategic Objective 3:

Provide employers with skilled new workers and support them to improve their employees’ skills

These objectives are made very visible in College publicity, as part of creating an organisational ethos for vocational education, and are clearly stated in their strategic plan which is shared with both students and employers.

The College is set in a rural area and is surrounded by a number of business and industries which rely on engineering and Information Technology skills including the Crawley/Gatwick international gateways and large business parks, as well as wider links into London’s private and public sector investment and banking services. The College has over 2,000 apprentices employed in the local and wider region and they maintain strong relations with their Local Enterprise Partnership and have worked with them to develop the skills strategy for the region.

The Computing and Engineering department has a total of 44 full-time staff and 6 part-time staff. The Computing section has 10 staff, of which 6 are part time and 4 are full time. They offer both full time and part time courses from level I to HND level in areas which include software development, networks, IT support, website design, 3d design, CAD animation setting up new systems, and solving complex business requirements.

Within the Computing section the Information Technology provision at level 3 aims to prepare learners for a number of career opportunities in the modern world of IT through course such as:

- EDEXCEL BTEC Diploma in Information Technology Level 3
- Information Technology Level 3 Extended Diploma
- EDEXCEL 90-credit Diploma in IT Level 3
- Games Development in IT Level 3 Diploma

Full-time courses (such as Information Technology Level 3 Extended Diploma) have the highest number of students.

One of the notable features of the provision is the extent to which the College has positioned itself to ensure that it can identify current skills needs and future trends. This includes through supporting the needs of local employers, and involving itself at a strategic level with their Local Enterprise Partnership (LEP).

The College also maintains a number of direct communications channels with a cadre of known employers, and utilises a range of activities which serve to either introduce the college to new employers or maintain active working relationships with those that they already engage. For example, the College maintains and develops new relationships with employers through monthly business breakfasts, regular e-bulletins, and putting employers and students/job applicants together through their “Positive about Futures” team guidance. The latter is an impartial careers and advice service located in the College which offers services to inform learners about their career choices, together with activities which will help them develop the skills employers are looking for. The College Business team also participates in a number of events across Sussex and Hampshire including joint organisation of events for National Apprenticeship Week, attending meetings and exhibitions through the Arun

Business Partnership, mid-South East England Chambers of Commerce and the Gatwick Diamond Business group.

It is pertinent to note that not all these involve the department staff directly, but in a recent inspection that gave the College an overall Grade 1 Ofsted commented on how all the links, systems and processes gave a sense that that everyone was pulling together and working towards the same goal.

The College promotes itself as working with employers in their publicity and marketing and has a number of other employer engagement strategies including:

- having employers on the Colleges governing body
- running a number of open days which link employers to learners
- entering into learner skills competitions as a way of building links with employers as well as linking learners to the world of work
- inviting employers into the College to do presentations and talks to learner groups about how to get into industry and what skills are needed

Another distinctive feature is how the College links the local community, through local schools and other groups (e.g. Cubs, Scouts), on the STEM agenda and uses this as a way of engaging with employers. The college either organises, or participates in, a number of open days and careers events as part of a strategic approach to engaging with learners while young. The College ensures STEM activities are highly visible throughout the year, with a yearly event which culminates in bringing employers and local schools together. The College has used high profile initiatives, such as the Bloodhound supersonic car challenge, to motivate and attract young learners, at primary and secondary level, to engage in STEM.

Enhancing learning through boundary crossing, tailoring and contextualisation

The approach to vocational teaching, learning and assessment in the Computing department is set within the overall approach taken by the College in providing outstanding teaching and learning in vocational and academic education and training (strategic aims 1 and 2) while meeting the needs of local employers (strategic aim 3). There is a determination to remain

inclusive, and cater for the needs of all students, whilst pursuing the goal of delivering excellent vocational teaching, learning and assessment and meeting employer needs. There are a number of strategies employed by the Computing department for boundary crossing, and contextualisation to ensure learners are equipped with the skills and knowledge to meet local employers' needs. Contextualisation of theoretical knowledge in the 'world of work context' is seen as a crucial principal, and one that is assisted considerably by the College's links with local business.

Dedication to continuously improve teaching, learning and assessment (TLA) is a common goal amongst all staff. Success rates in the Computing Department are typical of what is achieved at the College. Meadowside College has been the highest performing general further education college in Sussex for the third year running, and in line with the College's vision, puts it in the top 10% of all colleges in the country, with the overall College student achievement rate at 92%.

Another notable feature of this provision is the way that the College uses both formal and informal/peer observation of TLA facilitated through their "Licence to Observe" programme. This was designed and delivered by the College's staff development team, and ensures that all those evaluating the effectiveness of teaching, learning and assessment are trained to the same quality standard.

Staff may be formally observed by a 'licenced' observer, for example as part of preparation for Ofsted inspection or the Colleges self-assessment processes, or informally observed by one of their peers as part of personal development of their own teaching skills. The peer observation may be by a vocational specialist in a similar area or from a different discipline. The 'Licence to observe' training programme, which has been undertaken by all College observers, has been adopted by several external organisations, including one US organisation, and has recently been recognised with an AoC Beacon Award. It is also a substantive element of the 2014/15 "Outstanding Teaching and Learning" programme, commissioned and funded by the Education and Training Foundation which is being delivered cross the region.

The College encouraged sharing of effective practice through their "Teaching and Learning Takeaway" day, which was introduced to allow staff to benefit from good practice and

resources shared by colleagues from across the College. Since this proved so inspirational to staff, the College has since also introduced a series of Teaching and Learning Roadshows in which all curriculum areas, including Computing, share effective vocational practice with others in the organisation.

The College also employs Skills Champions to improve students' literacy and numeracy and to help embed the Skills Strategy across the College. They support the Computing staff, ensuring consistent quality assurance and maximising opportunities for the delivery of English and maths contextualised within the subject area.

Theory–practice consolidation

To supplement work placement, the College uses IT learners to support others in the College with their IT skills. IT learners form groups who go out to support students to develop their IT skills to help them complete their own project work. In addition, IT learners are also used to develop the IT skills of the teaching staff. One example of this is where a group of learners was used to support staff development in the College, by working with individuals and groups of College staff to develop their Moodle skills.

Within the department there is an IT lab which gives us a work type environment, and we build virtual environments to simulate different software and hardware. Speaking with employers and liaising with ex-students who are a similar age is important to us.

[IT Lecturer]

The Computing department makes good use of technology for learning through the College Virtual Learning Environment (VLE). The Meadowside Online Moodle has a high proportion of course content on it, and “if a student misses a day they can access that course content online”. More of the College course content continues to be placed on the Moodle, and students assist staff in developing the skills to do this. The College uses video and interactive whiteboards for demonstrations and presentations.

The College also seeks to use the technology that students own and bring with them – for example mobile phones, tablets and laptops. The view is that IT drives society and is ubiquitous, and the college seeks to utilise whatever technology that learners have access to.

One College contact told of an exercise where a tutor asked students to open their bags to show what mobile technologies they had with them. “We found that the class had around 20k of technology with them - we must be able to utilise that”.

The College uses a number of social media channels to communicate with students in preference to the College email account, such as Twitter, Facebook and Snapchat. The same college contact said “We found that email is dead in terms of getting a rapid response”. The college has also developed its own mobile app, Chi Space, which it uses instead of a commercial product e-Tracker. It was created internally and was developed and tailored so that students can turn in assignments track their progress online.

Practice in work placements: embedding theoretical knowledge and practical skills into the world of work

Our philosophy is that Students are being prepared for work or further study or employment. When courses are delivered – it’s all about the ethos of work;

- *Timekeeping*
- *Telephone manner*
- *Behaviours, attitude and even spirituality*

[Head of Computing and Engineering]

Within the context of the College strategic approach and ethos to vocational education, the Computing department has developed its own approach to respond to the needs of employers and providing work placements. The College provides a number of opportunities for students to have work experience, both on a paid and unpaid basis. However, finding enough links for work placements places a stress on Tutors and Managers. To illustrate this, there are currently 25 HNC students in their first year, and it is difficult to get work placements for them all, so the college has adopted a number of strategies to either provide or simulate the work experience element. The aim though is that the majority of students on full time programmes go on work experience, and progress onto apprenticeships or employment. Sometimes employers contact the college and want an apprentice, if so the

College has a process which assesses them for suitability. However, getting work placements is regarded as 'difficult'.

The College is aware that there are many IT jobs in the region for those that are prepared to travel a short distance so it casts the net for IT placements beyond the immediate locality. Just outside the immediate area there are a number of SMEs that the College partners with. For example, one of their ex-Level 3 student has set up their own Technical Support business and is happy to work with the College to provide work related support. He has proved particularly helpful in helping with placements and also in advising on the content of assignments. In the City Centre area there is also a web services organisation who takes on taken on level 3 students for part time and full time work. That contact also provides links to other sources of work placements further afield for L3–L5 students.

The College has had to innovate in order to give students the opportunity for work experience and the College offers work experience from a couple of hours a week to day release in a number of other contexts. As an example, Level 4 IT students offer technical support on a 2.5 days a week basis (and other times in case of IT emergencies) working in schools or other worthy groups. Working in a school means that students get work experience while providing a valuable service to the local community. It also serves to promote STEM to younger learners in line with the College philosophy.

As the College is itself a large employer in the region, there are also a number of opportunities for students in house. In addition, projects are constructed to emphasise the world of work. Examples are chosen which relate theory to practice, and quote practice that is relevant to specific companies, rather than in the abstract. Students on IT courses are supported before their work placement through a specialist employability module and the employability 'passport'. Other support given is about preparing them for work, understanding business, understanding the skills needed and interpersonal skills. Liaison officers are appointed to manage the relationships between the College, the employer and the trainee. Health and Safety specialists also visit to maintain a secure environment for the trainee, and departmental based assessors go out to do assessments.

Enhancing teaching and learning arrangements through tailoring to local industry needs

Providing employers with skilled new workers and supporting them to improve their employees' skills is a College priority, and working with employers is a major focus for the College. The College trains 1500+ Apprentices annually for over 800 employers. Success rates for Apprenticeships is 82%, ahead of the national average (72%). In addition, the College delivers training on the workplace to a further 500+ staff on qualifications, such as NVQs, in their workplace.

Ensuring the quality of provision for employers is critical and the College conducts an annual survey with employers. Feedback from this showed that 87% of employers reported that training had improved staff performance and 89% reported high levels of satisfaction with the professionalism of the College staff working with their organisation. The College also commissioned an external review of services provided by the areas of the College involved in delivering work based learning, and instituted structural changes to ensure the service to employers and work based learners continues to be as effective as possible.

The delivery of Computing has changes substantially over the past few years, and is much more tailored to employment and the needs of local employers.

We were once much more driven by the needs of the qualifications. Not now. We are more sensitive to the employment needs of learners and are much more employer driven. Now it's study programmes, employability skills and then the qualification.

[Head of Computing and Engineering]

The Computing staff adapt to meet the needs of employers and actively look for ways to write their own modules, tailored to local needs, and then integrate these into the structure of the course as options modules. Content is shaped to meet the needs of local employers and employers are consulted in the way that modules are developed and delivered to ensure that they are vocationally relevant and deliver the relevant skills. An example of this was when the college became aware of an employer demand for trainees with skills in the deployment and servicing of wireless technology. The Awarding Organisations (AO) used by

the College did not have a module on wireless technologies but, after discussing the needs with the employer, staff found a way of creating a module within the AO framework and adapted to create a new module on wireless technologies that met the skills need..

When you train students you are aware that by the time that they leave College their skills may be out of date for their employers.

[Head of Computing and Engineering]

Because the subject content of IT courses can be subject to much more rapid change than many areas of STEM, as new versions of hardware and software are continuously released, and the Computing department is very aware that it has to adapt dynamically and keep their own skills up to date in order to cater for local needs.

IT is one of these areas you have to adapt to, and allow for constant change. The College does support this, but the IT area is so vast and you have to do things off your own bat as well to keep up to date. [IT Lecturer]

In addition to working directly with local SMEs, which serves to identify what skills are needed and how things are changing in the industry, Computing staff undertake a variety of formal and informal CPD to keep them up to date as ‘dual professionals’ e.g. as teachers and as IT specialists. Some CPD is self-financed from self-interest, some opportunities are provided by the college, and staff utilise “time out” from teaching to develop and maintain their own skills and keep them up to date with subject matter. This often involves familiarisation with new software packages, programming languages or computer hardware.

One example of this was when the MD of one local contact who operates a web design business offered to give a talk to students about current industry needs and trends. The IT staff also attended the talk, and subsequently adjusted course delivery by purchasing a different software package. They then trained themselves up on the use of that package before offering it to learners.

Software licencing can be an issue for all SET departments. The College has however negotiated a reasonably good position by securing a Microsoft Dream spark licence programme which gives them access to many current Microsoft packages such as Windows 8.1, and Desktop Server 2012 on their internal server. Where specific software is required, the College will purchase it if demand is high enough and budget allows but this is not always possible. In some cases this means that generic principals are taught, with exposure to the actual software through work placement wherever possible.

There are highly effective progression routes for both academic and vocational students across all areas, and ensuring that learners are on the right course for them is seen as key. Every IT student in the department is interviewed before they make their course choice. Although this requires considerable resource – each interview takes between 0.5 to 1 hour - it also acts as part of the induction process to prepare them for their course and ensure that they have made informed choices and are happy with their choice of course. The retention rate is 97% so the College is confident that the process works - and the learner surveys provide further evidence to show that it is effective.

Students benefit from starting courses at an appropriate level for their entry qualifications, experience and choice of course. Once on course, students have an opportunity to choose further options in their second year once they have had an opportunity to experience their course and talk to IT staff, each of which has expertise in different areas. Students may choose from a range of modules and work opportunities that the Computing department have developed in response to the needs of local employers. The Computing department maintains a “clear line of sight to work” through a specialist employability module, linked to the Employability Passport, and by ensuring that contents is placed in the work context.

A number of teaching techniques are employed in the classroom e.g.

- Verbal input
- Questioning
- Demonstration
- Discussion groups

- Student presentations
- Practical activities
- Workplace simulations

Although lecturing does take place, the focus of the provision in the college is on learning rather than teaching. Computing staff facilitate learning rather than talk or teach didactically. Transfer from academic theory to vocational practice is achieved by contextualising knowledge in the world of work, and by practical assignment work and mini projects.

We use scenarios to facilitate the learning. Students work by experimentation and with staff facilitating rather than talking. The focus is on learning rather than teaching- and students gaining skills through research. [Head of Computing and Engineering]

The College philosophy to learning is that learners build up high level learning skills through problem solving and research. Scenario based learning is used facilitate learning through experimentation, with a focus is on students developing their vocational skills through research and linking vocational theory to practice. Students are set mini projects, contextualised in the world of work, and explore, analyse and develop solutions to problems supported by both tutors and peers. Providing peer support to other students is seen as a highly effective way of developing skills, giving learners confidence and enabling the transition from theory to practice.

Enhancing teaching and learning arrangements through tailoring them to the learners' needs

Culture is important in the department – the ethos and the philosophy of doing the best for each and every learner means adapting things on an individual basis. Enriching of courses and student support are strong, so in-course support is important.

[Head of Computing and Engineering]

The Meadowside College mission of 'Changing Lives Through Learning' means that the College is constantly reviewing and evaluating the education and training provided to ensure the needs of local communities are being met. The college aims to deliver vocational and academic education and training to students that will lead to meaningful careers so students are being effectively prepared for their futures, whether starting a job, changing career or going to university.

An innovative enterprise framework, supporting the development of English, maths, IT and soft skills underpins subject specific provision, enabling learners to progress from level 1 to level 3 courses and thereafter onto higher education, higher apprenticeships and employment.

To ensure that students are ready for work, the College has embedded its own “Enterprise passport”, based on the seven key employability skills which the Confederation of British Industry identified in successful entrants to the workplace, across the curriculum. Students keep a regular log and notes on progress on their employability skills. For example, students make notes on how to look for job, telephone manner, customer service attitude and ‘how to prepare for an interview’. Students present their findings to staff and to each other, and undertake mock interviews with their peers that they receive feedback on. All of this gets recorded on a “passport” which they can show to employers.

There is “Lots of individual tailoring – we have 25 HND students, some experienced and some newbie. We identify their needs at an early stage through diagnostic process, and then look at what skills they need to develop. We then then work on developing individual learning plans.” Because the College makes extensive use of scenario based project work it can increase the demand on equipment and software. “If it’s needed we buy different software packages so students can explore solutions. We recently bought a new 3d animation software package so a student could model a 3d animated face. A bit of extra kit was needed, but it enabled the students to work on a practical problem”.

College–employer links and partnerships

It is not easy to get employer engagement- you often need to go to them. Difficulty is about getting that initial employer buy in – but once done it takes off because they can see it will benefit their business.[IT Lecturer]

The College has developed many enterprise activities to engage with local employers by running several successful ‘Splash’ careers events where students have also developed their personal planning skills and benefitted from the expertise offered by mentors from companies as diverse as Google, IBM, British Airways, Mumpreneurs and local newspapers.

Employers were brought in by the Bloodhound car, but then they really 'got into' the College and it captured their interest.[Head of Computing and Engineering]

The College have supported activities during Global Entrepreneurship Week and created an Entrepreneur in Residence post offering an opportunity for a student to develop their own business ideas and skills. Work experience opportunities have been embedded into many courses and, in some areas, specific courses have been developed in conjunction with employers. The focus on careers and preparing students for work was also evidenced in the World of Work (WoW) event co-ordinated by the College, run in conjunction with local schools, employers and other training providers. The event received very positive feedback and won a national award from FE First for an innovative and successful careers event.

Many of the business in the immediate region are small to medium enterprises (SME's), and the department maintains active partnerships with these particularly for the provision of work placements and helping small businesses to solve IT problems. In addition, because entrepreneurship and employability skills are high on the Colleges agenda, the Computing department supports their students to set up their own businesses. The department then uses the relationship with these businesses/ex-students to support new students.

Working with local SMEs is part of the strategic approach taken by the Computing department. This often means that they will be supporting SMEs to implement vendor specific hardware or software solutions. For example, immediately prior to one of the interviews the head of the Computing department had just met with a representative of CISCO in relation to providing training for their equipment.

Employers were asking for CISCO academy skills and the same with VMware. I asked for a CISCO representative to come in to discuss what we could do to deliver their training - it makes the students much more attractive to employers that way.

[Head of Computing and Engineering]

As each case of working with an SME may require a bespoke solution, it places a lot of demand on members of the Computing team, but is a significant factor in allowing them to keep abreast of the demands of the local labour market and help to shape the departments

provision of training in the region. It also helps the department to source work placements for trainees.

Assessment strategies: contextualisation

The Computing department takes great strides to ensure that assessment is work related, and members of the Computing department utilise their expertise from different areas of the IT industry when creating assignments. They aim to ensure that the evidence produced by learners not only meets the requirements of the Awarding Organisation, but also enables the student to produce work which is relevant and current to specific occupational area(s) of the IT industry.

“We go out and talk to employers. It takes effort to do it- the restrictions on curriculum and assessment means it’s actually harder now. Edexcel have become much more strict and although it is rigorous there is much less flexibility and increasingly the deadlines for learners to submit are now much more fixed and this impacts on learners.”

The purpose of the assignments is to show that learners have demonstrated the necessary skills and competences and at the correct level. Evidence at level three needs to show an appropriate balance between theory and application, and may take the form of in the form of written work, written outputs from project work which includes material in diagrammatic form (such as flowcharts for example), computer programming with associated documentation or visual evidence of the outputs of programming, such as web pages or 3d simulations. The scenario based approach employed by the College lends itself well to this.

Employers are brought in to validate assignments – they are actively involved in melding not only the way the units are constructed, but the way that the assignments are written for the units to ensure that they are related to the real world of work. [Head of Computing and Engineering]

To ensure that assignments are as relevant to an occupational area as possible, where possible employers are asked to work with the College. These employers help develop assignments which contain sample problems which are relevant and ‘real’ to the industry, while the College staff ensure that the assessment are fit for purpose, demonstrate the achievement of the relevant learning outcomes and meet the award criteria of the AO.

One aspect that emerged during the interviews was how important the ethos of the organisation was to the quality of vocational education. A duality emerged with respect to this, in terms of the culture of the organisation and the importance of how the whole College approach affects the delivery of vocational education and training in the Computing department. An additional strategic objective to those already cited was that the college has set itself an objective of “Being a great place to work”. The Computing staff talk of a ‘zero blame culture where you are free to make suggestions and experiment’.

Professional development is a key focus and the Colleges approach was recognised by the Association of Colleges when the College was awarded a Beacon Award for the Licence to Observe course, which was developed to ensure a consistent high quality approach to teaching observations, helping to raise the standard of teaching and learning across the College. Managers are encouraged to develop themselves and a cohort of managers completed the aspiring senior leadership course, encouraging and preparing them for internal progression and development. The College celebrates excellence, in staff and students, through various awards both internal and externally recognised. The college also uses competitions as an additional way of demonstrating and celebrating excellence, as well as linking them to local employers. Ensuing that students are prepared for employment and making their courses truly work related are clearly set out in the aims of the organisation. This means that positive and motivated staff, working closely with local employers, continue to drive through improvements, ensuring that students receive an excellent experience.

5.4. Dockside College

The context: teaching and learning arrangements

The delivery of a range of engineering courses has been a well-established provision at Dockside College for several decades. The college prides itself in providing a high-quality career-focused learning experience. Dockside College offers academic and vocational courses in Electronics, Electrical and Mechanical Engineering. The professional excellence and commitment of the teaching staff is one of the strongest assets of vocational provision

in the college. Ensuring that learners benefit from high quality courses that aim to equip them with the skills and knowledge required by contemporary and emerging economies is one of the most significant objectives of the engineering department.

The engineering provision at Level 3 aims to prepare learners for the world of work, focusing on developing the skills and knowledge required by the local employers. Through courses such as the BTEC / Edexcel Level 3 Certificate in Engineering as well as the Level 3 apprenticeship, learners are given first-hand experience and learn skills that can be applied in the engineering sector. The courses include both full-time and part-time training opportunities. Full time courses have the highest numbers of students in engineering.

The engineering department has developed strong partnerships with secondary schools in the surrounding areas, and offers a pathway from 14–16 through to Chartered Engineer status.

One of the most distinctive features of Engineering provision in the college is its strong agenda to anticipate future developments and the emerging needs of the local economy and to ensure that learners are equipped with the skills and knowledge required not only by the current needs of local industries but also those anticipated for their future expansion and developmental opportunities. This is achieved through planning, research and strong links and collaborations with local employers and other stakeholders. There are various opportunities for developing a range of collaborative activities with local employers and meetings with employers are held on a regular basis. Other events that provide opportunities for developing local industry representatives' engagement are 'Employer Events' held locally. Such occasions play a significant part in sharing good practice and developing links and connections between employers and local colleges/training centres. Presentations from employers illustrate, for example, the way process industry companies are working in partnership to prepare apprentices for work and helping the existing workforce to develop new skills. The engineering department prides itself in continuous collaboration with local and national employers including BAE Systems, Doosan Babcock, the ChemSkills group of employers and the Electrical contracting industry. The North West Chemskills Group is an example of local employers' cooperation. It is a network of 40 companies represented by

those with responsibility for training and development in their workplaces, who also cooperate with the National Skills Academy Process Industries and Chemicals Northwest to promote vocational excellence and workplace training frameworks, specifically through approaches such as sharing good practice and information, sharing resources, discussing issues and problems, helping to shape the provisions of training and development in the region.

The department has developed a strategic approach that aims to respond to the needs of local industries by providing them with skilled trainees and employees. The core of this strategy is in facilitating collaboration with local businesses with the purpose of sharing experiences and co-developing curriculum and teaching approaches that are tailored to the needs of the local labour market.

These strategic developments contribute to formulating the fundamental principles of vocational pedagogy across engineering courses. Vocational pedagogy is achieved through a range of approaches that the teaching staff employ while developing teaching and learning content and arrangements. Bringing together subject-based and work-based knowledge, in ways that meet the requirements and expectations of the learner/employee, the employer, the provider, the awarding and professional bodies, is considered to be one of the most significant underlying principles that permeates the engineering curriculum.

The strategies that provide a foundation for the implementation of this principle across the courses are based on the concepts of boundary crossing, tailoring and motivating. As discussed in the Section 6, these concepts are strongly related to the development of vocational pedagogy and practice within both the workplace and college contexts. A recent example is the development of a collaboration between the School of Engineering and the School of Construction. The objectives of the collaboration were to create synergies between the two schools with the purpose of sharing good practice and developing various collaborative activities. This initiative between the two schools has resulted in the subsequent merger.

Enhancing learning through boundary crossing, tailoring and contextualisation

The provision of the teaching process in the college focuses on the delivery of excellent academic teaching combined with vocational practices. Contextualising academic knowledge

acquired in college within the context of vocational practice has been considered as a fundamental principle of the engineering provision. Different strategies related to boundary crossing, knowledge transfer and tailoring the provision to the needs of local industries have been employed in order to make the contextualisation meaningful and productive for both learners and employers. These processes specifically underpin the significance of embedding theoretical knowledge and practical skills into the world of work and demonstrating its relevance to the practical context of the workplace.

Demonstrating how theoretical knowledge could be transferred to and contextualised in the world of work has become one of the guiding principles of employing a range of teaching approaches in the classroom. These teaching approaches include a combination of the following:

- verbal input from tutors;
- time for questions from students;
- visual demonstration;
- discussion groups;
- student presentations;
- practical activities.

Lecture and seminar content is strongly related to practical activities. The diverse ways in which lecturers create vocational courses ensures a creative balance between content and learning outcomes and between practical and theoretical activities. This is illustrated by the choice of modules and diversity of ways of demonstrating that learners have met their learning outcomes.

Choosing modules for specific courses is regarded as one of the ways to ensure that the delivery is tailored to the needs of local industries, thus facilitating the contextualisation of knowledge into practical activities. Course content development is considered to be a collaborative process that involves cooperation between the college, the awarding bodies and the industry. The guidelines from the awarding bodies stipulate the core modules for specific courses, whereas a number of optional modules could be selected by the engineering curriculum team at the college, with the selection based on taking into account the needs of learners, the requirements of local businesses, and the current priorities of the college.

For example, when it comes to BTEC qualifications at Level 3 (BTEC Level 3 Extended Diploma in Engineering), there are some core units, such as *Health and Safety in the Engineering Workplace* and *Mathematics for Engineering Technicians*. However, there are many optional modules the curriculum team could choose from, e.g. *Engineering Primary Forming Processes*, *Engineering Secondary Finishing Techniques* and *Fabrication Processes and Technology*. In choosing a range of optional modules, the curriculum leaders try to take into account the requirements of the local market:

We are keeping in mind what industries are around, and trying to shape our curriculum, to ensure it's relevant to the local needs and learners' employability. [Curriculum leader, engineering]

Within specific modules, contextualising vocational knowledge is closely related to incorporating practical skills in the curriculum.

At Level 3 the curriculum could be very much theory-based, so we try to put some practical element into our modules' delivery to ensure that the students get hands-on experience in using machines and equipment. [...] We are trying to give them a mix of skills, as most of our students tend to go and work for local industries (e.g. small machine shops). [...] We try to arrange our courses the way that students are learning from both research and experiences rather than just from research. [Curriculum leader, engineering]

The curriculum is organised to ensure that the learners (both full-time and part-time) have an opportunity to practice in on-site engineering workshops every week (at least 3 hours every week). The format and methods of teaching within the college encourage the contextualisation of theoretical knowledge within the context of vocational practices. The members of the curriculum team have emphasised the significance of choosing an appropriate format for teaching sessions, and tailoring them to both the learners' needs and the requirements of the sector. The majority of staff, coming from an engineering background, would be delivering both theoretical and practical teaching in the college. Most of the sessions would involve a mixture of spoken input from the tutors, discussion groups as well as student presentations and demonstrations.

Contextualising theoretical knowledge within vocational practice is achieved through demonstrating the relevance of academic knowledge to the real-life workplace context. Theoretical input from the tutors would usually be followed by a discussion and a range of

practical activities, such as demonstrations, workshop simulations or hands-on tasks undertaken in one of the on-site engineering workshops.

The tutors have further underpinned the role of an interactive element within the teaching sessions that would ensure students' involvement and continuous active participation. Visual images, video extracts, workshop simulations and demonstrations as well as hands-on experiences for the students are used to exemplify the relevance and contextualisation of theoretical knowledge within the context of engineering sector practices. As noted by one of the tutors:

Sometimes they [the learners] have a theory-based teaching session, and then straight after the session they would go to the workshop to see how this theoretical knowledge could be applied in the workshop.

Such approaches enable the learners to connect theoretical knowledge with practical activities, thus facilitating the contextualisation of subject-specific knowledge to practical vocational contexts.

The recognition of the role played by knowledge contextualisation, and specifically the ways it relates to boundary crossing between education and work, has been at the core of the meanings and purposes of work experience and work placements for the learners. Providing students with a wide range of opportunities to undertake practical work activities and tasks that relate to their courses' subject-specific content has been incorporated across the engineering curriculum. Tutors and curriculum leaders have emphasised that delivering both academic knowledge in the classroom and its practical illustrations in the workshops has been one of the most distinctive features of the engineering provision.

Theory–practice consolidation

Theory–practice consolidation relates to opportunities to contextualise and associate the experience of work to course content and vice versa. The engineering department prides itself in incorporating meaningful practical activities and tasks into theoretical courses. Integrating subject-specific knowledge with practical work is one of the approaches that has been employed across the modules. The college campus provides a range of 'realistic working

settings' including engineering workshops and laboratories. These 'industry standard facilities' enable learners to develop skills which will transfer to the workplace, ensuring that they are prepared and confident when in the workforce after completing their studies.

Theory-practice consolidation is also associated with another important dimension, which relates to the development and use of modern technologies in work-related learning settings. Docksider College uses technology, such as videos, Virtual Learning Environment (VLE) and portable devices, to provide practical skills demonstration that students can access within their academic training settings. Modern technologies play a significant role in facilitating the connection between theory and practice. New technologies are used to strengthen the delivery of academic teaching combined with vocational practices, specifically through introducing a range of innovative approaches, which enable learners to respond to their individual learning needs and requirements.

Virtual learning is delivered through a range of portable devices (such as mobile phones or touch-screen tablets), which enables the college to facilitate anywhere, anytime access to learning resources for students. Demonstration of practical activities is available on the college VLE and can be downloaded by students using Quick Response (QR) codes, enabling them to get access to learning resources, including demonstrations, anywhere and anytime (e.g. learners can then access them on their own mobile devices at any time).

Both the college and the industry representatives emphasise that modern technologies provide opportunities to facilitate and support teaching and learning practices within both the workplace and college contexts, in particular, by providing flexibility of time and place of delivery; allowing the sharing and re-use of resources, facilitating theory-practice consolidation and collaborative working. Docksider College prides itself on the innovative quality of its vocational teaching and learning practices, that allow the college to develop a high level of professionalism, in particular, through bringing together subject-based and work-based knowledge.

Within the engineering course, work placements and work experience are regarded as an important element of theory-practice consolidation within the engineering course provision. The incorporation of work placement opportunities is considered by tutors, learners and

employers to be a significant element that facilitates the process of integration of subject-based and work-based knowledge within the context of the contemporary workplace.

Practice in work placements: embedding theoretical knowledge and practical skills into the world of work

Collaboration between college and employer is crucial for making this a successful and meaningful experience for both the learners and the employers. The collaboration between employers and college staff aims to design and continuously improve practices and approaches to induction, coaching and feedback, as well as participation in routine and novel activities. Developing methods of observation and shadowing has also been regarded as important and significant for awarding vocational excellence and strengthening the links between the workplace and the college.

Arrangements for acquiring work experience and obtaining work placements vary between different types/levels of engineering courses. Part-time students and apprentices usually acquire work experience in the context of their primary employment. For full-time 16-19 students, education and training providers are required to include relevant work experience as part of a learner's full Study Programme. The introduction of Study Programmes is a key aspect of recent government policy implementation following recommendations made in the *Review of Vocational Education: The Wolf Report*. This has been referred to as work experience rather than work placement, as the purpose of such experience is to broaden the students' horizons and give them a flavour of what the real workplace context will be like. The expected outcome is that the work experience will raise the learners' industrial awareness and contribute to skill modelling and development. The minimum requirement for the duration of such a work placement for full-time students is currently 10 hours a year (usually combined into 2 days of experience), which places a new responsibility on the college engineering staff.

It's challenging. We have across the college 4000 full-time students. Can you imagine getting work experience placements for all of them? It puts a lot of pressure on us. But you've got to start somewhere. [College practitioner].

Regular meetings and feedback between the employer and the college are considered to be an essential element of this scheme. One of the most significant challenges that has been identified by the engineering department staff is how to make this experience meaningful for the students. The incorporation of work experience opportunities is considered by tutors, learners and employers to be a significant element that facilitates the process of integration of subject-based and work-based knowledge within the context of the contemporary workplace. Collaboration between college and employer is crucial for making this a successful and meaningful experience for both the learners and the employers. Developing methods of observation and shadowing has also been regarded as important and significant for awarding vocational excellence and strengthening the links between the workplace and the college, thus facilitating learners into boundary crossing between college and workplace. Collaboration between employers and college staff aims to design and continuously improve practices and approaches to induction, coaching and feedback, as well as participation in routine and novel activities.

Enhancing teaching and learning arrangements through tailoring to local industry needs

Over the years, the delivery of engineering courses has been subject to continuous modifications and improvements with the purpose of making the provision more relevant to the constantly changing requirements of the local market and industries. Tailoring course curricula to the needs of local employers has been regarded as one of the most significant and pressing challenges to be addressed by both the engineering department staff and local employers.

We are trying to look at what the local industry's needs are through talking to our commercial partners and shaping our curricula around this [Head of Division for Engineering and Construction].

One example of tailoring the engineering curriculum to the needs of local businesses is the response of the college to a newly emergent opportunity within the development of local industry. Siemens has recently announced its decision to invest £160 million in wind turbine production and installation facilities in Yorkshire. With this initiative Siemens is investing £160 million across two locations and its port partner Associated British Ports (ABP) is investing a further £150 million in the dockside development region. The investment is expected to provide a huge boost to the UK's offshore wind industry and the locality and to

create up to 1,000 jobs directly, with additional jobs during construction and indirectly in the supply chain. The engineering department's response was to incorporate activities and tasks within a range of courses that would enable learners to develop a range of skills (e.g. maritime skills) to facilitate their competitiveness for these future job opportunities. As noted by a member of curriculum development team:

We are always looking ahead, and trying to find ways to strengthen employability chances for our learners. If there is a business development opportunity within our local industry, we would like to make sure that our learners acquire skills and knowledge that would make them competitive in the job market. Thus we are serving both our learners' and our local businesses' needs [Curriculum leader, engineering].

Enhancing teaching and learning arrangements through tailoring them to the learners' needs

Ensuring that teaching and learning processes have been tailored to learners' needs has been emphasised as one of the fundamental principles of the provision. The notion of learner-centred approaches has its focus on equipping learners with a range of skills that they can employ successfully in the workplace. Anticipating the future needs of local economies, as demonstrated by the example above, as well 'skills change for the future' has contributed tremendously to the development of learner-centred approaches across the engineering department. As noted by the Senior Curriculum team leader, the main drivers of skills change over the next two years that were identified in collaboration with employers are as follows:

- Implementation of new technologies, equipment;
- New legislative or regulatory requirements;
- Development and implementation of new products and services;
- Introduction of new working practices;
- Introduction of new/updated health and safety procedures;
- Increased competitive pressure.

As emphasised strongly by the Head of Division for Engineering and Construction, learners feel more confident and motivated 'looking into their future job prospects' if they are equipped with skills that relate to new emerging job opportunities within local industries. This approach demonstrates the way the concept of boundary crossing between current and future industry developments relates to the notion of tailoring the curriculum to the needs of local economies, and further underpins the significance of boundary crossing between education and the world of work.

The philosophy behind the learner-centred approach relates to recognising the learners' ambitions, progression needs and career opportunities. College staff members encourage students to progress to a higher level (e.g. to Level 4) or to look for opportunities to start an apprenticeship or enter employment. The engineering department team members monitor the progress of students and provide career advice and assistance in identifying appropriate employment opportunities for students. Learners who start as full-time students in the first place within the college would often transfer to part-time courses after they secure employment. The engineering department prides itself in developing this supportive environment for the learner, which enables them to consider their best career and educational routes. The course (e.g. the choice and sequence of modules) is designed in a way that would encourage progress to a higher level, e.g. from Level 3 to Level 4, and to ensure a seamless transition between full-time and part-time courses.

College–employer links and partnerships

Local employers and the college recognise the significance of developing and maintaining collaborative activities and links between educational institutions and workplaces. Examples of good practice include a range of joint (employers–college) initiatives in developing and co-developing courses, modules and work-placement schemes that involve collaborative activities of both local employers and the college.

Employers' engagement is considered to be a crucial factor for strengthening the links between theory and practice. An example of cooperation with employers relates to design and delivery of courses for part-time students who come to the college on a day-release basis. Tutors stress that they aim to work closely with employers and discuss the progress of the students. In each instance the drivers behind facilitating the engagement with

employers would vary; however, in most cases this would involve joint efforts of members of the curriculum team and the Head of Division for Engineering and Construction within the engineering department.

Engagement with employers through designing and delivering apprenticeships is another illustration of a meaningful collaboration. One example of a successful collaboration includes a bespoke oil industry apprenticeship scheme, co-designed by the college and the employer (Total Oil Refinery). Developed locally by the member companies of the 'ChemSkills Group', the apprenticeship scheme was launched in September 2009, and since then has been creating the specialists the industry needs. This example of the development of excellent vocational practice through launching an innovative joint college–employer (oil refinery) apprenticeship scheme demonstrates not only the employers' engagement but also the employers' initiative and enterprise in developing this joint programme with the college. As described by the training coordinator (on the employers' side), the main factors that facilitated him and his team to seek partnerships with the colleges have been related to a range of industrial needs within the company:

We knew what we wanted from a practical point of view, but we did not know what is required from the academic side. For example, what is the corresponding level/size of the qualification? That's why we approached the college and discussed what they could offer on their end of this proposed partnership.

We had identified a skills gap in this area and wanted to develop a way to fill it that led to a nationally recognised qualification that would bring young people into the industry [Local employer].

The scheme ensures that the apprentices, who have already come out of their time and become fully fledged employees, have fitted into the workforce well. As noted by the training coordinator of this apprenticeship programme:

Both the college and the industry representatives have emphasised substantial benefits associated with such a joint initiative for the learners, the college, the industry and more broadly for the local community [Training coordinator].

The training coordinator of Total Oil has specifically noted that this programme:

- forms part of their succession plan at the Refinery;

- facilitates loyalty and motivation of apprentices and employees;
- provides good-quality training;
- levels out the age profile across the Refinery, as seen in the experience of 2005–09;
- provides the chance to develop a bespoke course working with other companies;
- provides the opportunity to make process-operating a recognised trade with good prospects and a career structure;
- introduces young people into the oil business.

The success of this joint apprenticeship scheme is seen as a result of the vocational practice developed within a close college–employer collaboration. Employers’ active engagement means that there are regular consultations and negotiations that contribute to further development of vocational practices within this scheme. College tutors visit the workplace on a regular basis to monitor the learners’ progress within the workplace and to provide/get feedback from employers.

This programme is an excellent example of how a college and industry can work together to achieve the required outcomes for existing, new and future workforces. Once the programme was running, it was periodically attended by TOTAL (the industrial partner) trainers to monitor and review the outcomes. They would also share formal feedback from candidates with the college trainers. Due to the strong relationship between TOTAL (industrial partner) and Dockside College, the programme has been very successful. Both the college and the industry representatives see this initiative as a big contribution to help bridge the skills gap in the process technology and engineering sectors.

There are various opportunities for developing further collaborative activities with local employers and meetings with employers are held on a regular basis. The Head of the Engineering Division underlined the significance of consultations with local industry representatives. Such meetings take place every two months, where the engineering department team meet with all the employers of their current students (part-time students and apprentices):

At the present time there are around fifteen employers who participate in the meeting. Employers may suggest changes that the college staff would consider for making some improvements and modifications to the curriculum. We consider it as an important contribution. [Member of curriculum team]

Other events that provide opportunities for developing local industry representatives' engagement are 'Employer Events' held locally. Such occasions play a significant part in sharing good practice and developing links and connections between employers and local colleges/training centres. Presentations from employers illustrate, for example, the way process industry companies are working in partnership to prepare apprentices for work and helping the existing workforce to develop new skills.

The significance of working in partnership with employers has been strongly emphasised by the members of the engineering department. Engaging employers contributes to making a link between theory and practice, enabling meaningful application of theoretical skills in the workplace:

When students get into the workplace they have technical theoretical knowledge that they can apply in the workplace. [Head of Division for Engineering and Construction]

Assessment strategies: contextualisation

The engineering department has adopted a mixture of assessment methods and approaches. Assessment criteria are specified by the awarding body; however, the college takes responsibility for developing appropriate assessment techniques. Engineering courses are assessed by Dockside College assessors and in some cases by representatives of the awarding body. The philosophy behind the assessment tasks and activities incorporated within the curriculum is that the learners need to produce valid, sufficient and reliable evidence that relates directly to the specified criteria and demonstrate that they have achieved specific learning outcomes. The purpose of assessment is to demonstrate that effective learning has taken place to give learners the opportunity to meet the assessment criteria, to achieve the learning outcomes within the modules and to demonstrate that they have engaged with an appropriate level of the qualification. Engineering department staff members employ a range of strategies to provide learners with the opportunity to produce evidence in a variety of different forms, including written reports and graphs, along with projects and performance

observation. Learners need to demonstrate competence and obtain the qualification largely by producing written assignments and through practical work performed in classes or workshops. The curriculum team takes responsibility for designing assessment strategies, ensuring that assessment approaches are reliable and fit for purpose to demonstrate the achievement of the learning outcomes.

The department has developed a strategic approach that aims to relate assessment methods to practical activities within an occupational area. For example, the assessment at Level 3 is largely designed as a theory-based assessment; however, the tutors make a point of designing the assessment in ways that contribute to contextualising theoretical knowledge within practical activities and, more broadly, within an occupational area. As noted by the curriculum team leader, the assessment, which involves an elaborative part (written work) and a math calculation, would be contextualised and linked to a recent practical activity undertaken or observed by learners within their college settings. This also fits with BTEC requirements, which state that training centres are encouraged to emphasise the practical application of the assessment and grading criteria, providing a realistic scenario for learners to adopt while making maximum use of practical activities and work experience. The creation of tasks and strategies that are fit for purpose for assessment is crucial to achievement and their importance cannot be overemphasised.

4.5. Riverview College

The context: teaching and learning arrangements

Riverview College is a large college of further education with approximately 20,000 students enrolling each year. The College has since 2009 made impressive progress establishing itself as a new and dynamic organisation with a 'one College' culture. The curriculum offer is very broad with a wide range of provision from pre-entry to degree level. The students come from a variety of backgrounds and experiences, including young people, adults and older learners. The college is fully committed to providing learners with high-quality, diverse and innovative learning opportunities that enable them to enhance their life chances and progress in their chosen career and occupational routes.

The college considers itself an engineering specialist. The engineering provision is characterised by a 100 per cent success rate. Prioritising vocational courses that give young people and adults the skills they need for sustainable employment and valuable careers is considered to be a significant objective. This means providing opportunities for individuals, employers and the local community. The Department of Engineering is strongly committed to developing a range of innovative approaches to enhance the delivery of engineering provision. The underlying philosophy is strongly related to facilitating the learning process through crossing the boundaries across different elements and spaces associated with the delivery of engineering provision. The configurations of these processes have resulted in a range of developments, specifically in those related to using modern technologies for STEM (science, technology, engineering and mathematics) delivery, knowledge sharing among engineering professionals and facilitating young people's interest in the engineering specialism through a targeted recruitment strategy.

These developments have been evident through implementing ground-breaking approaches in using modern technologies to facilitate teaching and learning processes in STEM programmes. Another significant strategy is concerned with sharing ideas and experiences within and beyond the college's settings, with the purpose of learning from 'peer' experiences and practices. Engineering courses available in the college include a wide range of course at different levels. At Level 3 provision, the courses that have the highest number of students include Electrical/Electronic Engineering BTEC Extended Diploma and Electrical/Electronic Engineering BTEC Extended Diploma (full-time).

The underlying philosophy of the department is strongly related to the notion of contextualisation of skills and knowledge within the context of practical activities, employment and industry as a whole. Demonstrating the ways that academic knowledge acquired in the college could be made relevant (and contextualised) to the demands of local employers and industry is considered to be a significant priority for the tutors. The general practice in the college is to employ a number of approaches to exemplify how what the students learn in the college could be contextualised in a range of other settings and contexts.

Enhancing learning through boundary crossing, tailoring and contextualisation

Boundary crossing within and between the context of education and work is achieved through demonstrating the ways that knowledge and skills could be transferred between the college setting and the world of work. The first step, as college tutors note, is to demonstrate the links between college-acquired knowledge and workplace settings:

To achieve this we try to make our workshops look as real-life as possible within the college setting. We use simulation strategies a lot. We simulate real-life workplace situations and problems. When our students employ their problem-solving skills, we try to ensure that they would be able to employ them in real workplace settings [College tutor, engineering].

One of the strategies employed across the department's courses is to deliver the course content through a combination of engaging the learners in work-related activities and teaching them academic skills:

Most of our classrooms are both workshops and lecture rooms which provide opportunities for hands-on activities and exercises. The learners are encouraged to relate their skills to practical activities through engaging in practical exercises. [College tutor, engineering].

The tutors indicated that the learning space and its design contribute to contextualising the academic knowledge in practical activities and helps to raise the learners' awareness of real workplace settings and environments.

The Engineering Department has a firm commitment to enhancing teaching practices through sharing experiences and examples of good practice among staff members. Peer observation is one of the key approaches being implemented in the college with the purpose of improving teaching and learning processes. The idea behind this approach is to enable tutors to learn from each other's experiences, to identify strengths and weaknesses (both their own and those of their colleagues) and to reflect on any emerging problems, issues and concerns related to the delivery of engineering courses. As noted by the Head of Curriculum (Engineering):

The way I see it, it's meant to engage two members of staff to engage with each other, to identify potential concerns, and to reflect on ways of enhancing teaching and learning practices.

If Lecturer A visits Lecturer B, especially if they both deliver similar subjects, they can engage in a meaningful discussion. [College practitioner]

Peer observation is regarded as part of staff development, involving tutors (and curriculum leaders) visiting each other's sessions, seminars and practical activities.

In the field of engineering this exercise is regarded as significant, as this gives the tutors the chance to learn from each other, and share best practice, in particular those that relate to the use of modern technologies and other innovative initiatives within both theoretical and practical activities. Learning and sharing experiences on how to link theory and practice is fundamentally important, and the process of peer observations enables the tutors to share their experiences, practice's and teaching approaches.

Boundary crossing through mobile learning

Using modern technology to facilitate boundary crossing and to emphasise the links between theory and practice have become one of the key strategies that have created a new dimension of vocational pedagogy. The significance and value of mobile learning has been recognised as an approach that could contribute considerably to boundary crossing between different settings and spaces, including work-related and learning spaces.

The department has become committed to developing a range of initiatives facilitating efficient engineering provision across different courses and modules. One of the most distinctive features of teaching and learning approaches has been associated with developing and drawing on technology-enabled learning solutions and services. In the setting of the Engineering Department, technology is used to enhance the delivery of modules by introducing a virtual learning approach, which enables learners to shape and personalise their learning environments in order to respond to their individual learning requirements.

Virtual learning is Cloud-based and facilitated through WiFi networks. The key benefits of using the Cloud include those of convenience and accessibility, as well as providing opportunities to deliver flexible learning, in particular, by providing flexibility of time and place of teaching and learning and allowing the sharing and re-use of resources, thus enabling individual responsibility and initiative. Specifically, the Cloud has been used to deliver course content using the following blended learning and mobile learning solutions: LJ Create

software and Crocodile Clips' Yenka software. Both software solutions provide foundations for mobile learning through the Cloud. Yenka modelling software is strongly based on the principle of 'Learn by experimenting in a safe virtual world', which is now available to access anywhere within college settings. LJ Create specialises in blended learning solutions for teaching Science and Engineering, and can be accessed both within the college and outside the college setting. Using this software via the Cloud enables the department to facilitate anywhere–anytime access to learning. This Cloud-based learning programme provides learners with flexible learning opportunities. The primary purposes of employing this software include those of *representation*, *practice* and *assessment*. Interactive representations provide both whole-class teaching and individual study. Interactive presentations cover a broad range of topics in electrical engineering, for example:

- Circuit diagrams
- Electric motors
- Electrical principles
- Simple circuits
- Work and efficiency

The software offers resources for the teaching and learning of a range of academic (theoretical) skills and further provides virtual demonstrations of how these theoretical skills could be applied in practical activities. The element of interactivity is one of the key benefits of this learning resource. Students are engaging with virtually presented practical activities that are based on real-life problems and solutions. Solving various problems and applying their theoretical knowledge in virtual practical activities contributes to consolidating theory and practice through blended learning approaches:

Even if it's something simple like calculating the value. And there is evidence in the class that the students learn and understand these concepts better if they have the opportunity for hands-on experience offered by the software. There is also a demo of practical activities and the students need to use problem-solving skills to find solutions for real-life situations. [College practitioner].

Through this technology the students are given an opportunity to practise and self-evaluate their own skills and knowledge, both during their classroom activities and while undertaking

revisions at home. Crocodile Clips software (Yenka) is on the college network, and can be used anywhere in the college. The software enables to investigate statistics, probability, 3D shapes and coordinates, using their ready-made models or creating your own from scratch. Yenka modelling software provides a way of consolidating theory and practice in a virtual world:

Virtual simulation saves time. They show you how to create your own simulated experiments using Yenka's virtual labs. It lets you design circuits, with a vast library of digital and analog electronics, and convert them to PCBs for manufacture. You can program, and model the circuit in full 3D, with mechanical inputs and outputs. [College practitioner].

As a result, Yenka's interface is easy to learn, and the software simulates as you work – so you can see how your changes affect the circuit straight away. At the same time, it does not mean that learners operate in an isolated ‘learner-to-computer’ virtual environment, lacking face-to-face communication with a tutor. The learners are fully supported by the tutors who provide the necessary on-site additional guidance, support, feedback and assessment for learners. As noted by one of the tutors:

It's all based around them doing work on the computer, the e-learning side of it, with the learning support managers, which is what I am, going in on a regular basis to see how they're getting on, to reinforce the e-learning on a one-to-one basis.

As a result of the flexible arrangement adult learners feel motivated towards the acquisition and improvement of their skills. The changing notion of the learning space indicates that the traditional classroom is not the only or exclusive site for skills and knowledge acquisition, development and assessment. The innovative provision, launched by Riverview College, has shown the benefits of flexible training that allows learners to shape their own learning agendas around their working and personal requirements, needs and circumstances.

Theory–practice consolidation

Encouraging the learners to reflect on the consolidation of theory and practice is an important strategy. The tutors believe that such reflection contributes to students' motivation and attitudes to learning:

Ultimately, all our learners have one objective – to find employment (or to start an apprenticeship). If they have a clear understanding that what they are learning in the college could be applied successfully in the workplace, they feel more confident on the job market. This helps them to locate their skills within the context of employment requirements. [College practitioner].

The strategic direction of the department emphasises the importance of employers' engagement and links with local industries:

If we know what the local employers want, we can direct our learners, and help them to make their skills more relevant to the requirements of the local labour market. [College practitioner]

As part of the course content, the tutors incorporate references and examples of the ways that the course material could be used and employed in workplace or community settings:

This enables the learners to make the link between the theory and practice and to see the relevance of the theoretical knowledge to the world of work. [Tutor, Engineering]

Enhancing teaching and learning arrangements through tailoring to local industry and learners' needs

The interviews have indicated that the concept of the 'way forward' is strongly associated with addressing the needs of local industries. The vision of the structure of engineering qualifications is strongly based on focusing on the needs of local employers. As noted by the Head of Curriculum (Engineering), a qualification make-up should involve some flexibility that would allow the inclusion of modules suggested by local employers.

The Engineering Department attaches great importance to engaging young people with the world of Engineering, specifically through their recruitment policy. The recruitment strategy is considered to be a way to provide young people with basic knowledge about the engineering sector, and the ways that acquiring a qualification in this occupational area could improve their life chances and personal development. The recruitment strategy draws strongly on the notion of crossing boundaries between young people's worlds and aspirations, their previous learning experiences and skills and engineering specialisms.

Continuously looking for ways to improve the recruitment policy is one of the priorities of the Engineering Department. The high reputation of the college and that of the department, in particular, is a significant factor that helps to facilitate recruitment strategies and success.

Open days are considered to be a crucial element of the recruitment strategy. Any student who expressed an interest would be invited to an open day, where they would be provided with information about the courses, given advice about possible career/occupational routes, and be further engaged in a range of activities such as some tests and problem-solving exercises:

The idea is not to test them but to spark their enthusiasm; we provide further support with discussing their results in a conversation that follows. [...] We try to establish if a specific course would be right for them, and vice versa – if they would be right for the course. Those who would like to go ahead would be invited for a formal interview that would involve assessment. We need to see their potential; specifically, they need to demonstrate that they are capable of solving a problem, which is a fundamental of the engineering field. [Head of Curriculum, Engineering]

The recruitment strategy further builds on links with local schools and local employers. As noted by the Head of Curriculum, the future of recruitment approaches is strongly associated with facilitating employers' engagement. At the present time, employer involvement resulted in recruiting apprentices (in Civil Engineering):

For now, employers send us apprentices in Civil Engineering. We are hoping to develop new links with employers, so they could send us apprentices in Electrical Engineering. Our recruitment would go up dramatically if we could get the right companies engaged with us for apprenticeship schemes. [Head of Curriculum, Engineering]

6. Case Studies: Themes and Issues

6.1. Cross Case Study Themes

The unifying theme in the colleges' diverse activities, which were described in the case studies in the previous section of the report, is that they are committed to continually crossing boundaries to enhance the quality of vocational learning and teaching. The four main boundaries are between: a) colleges, local employers and communities, learners and families; b) pre-given course and qualification requirements and local employer needs; c) theoretical and practical learning; and d) learners' initial interests and preoccupations and their potential to expand their horizons, through participating in the range of learning and teaching activities within the college, through work experience, and as a result of their own self-directed efforts.

First and foremost all colleges have a range of highly developed and very successful employer engagement strategies to ensure that their different SET programmes articulate clearly with local economic needs. They achieve this goal by, for example, holding regular business breakfasts for employer, training providers and intermediary bodies (i.e. LEPs), issuing regular e-bulletins to 'breakfast' members and intermediaries, participating in local employer established groups and forums, as well as participating in cross region events such as, National Apprenticeship Week, Chamber of Commerce organised exhibitions etc. This range of employer engagement activity serves both a strategic and operational purpose: in the case of the former, it simultaneously promotes the expertise of college staff to employers and enables college managers to learn about technological change and to consider with other senior colleges, at a later stage, how to support employers to address changing skill needs; and, in the case of the latter, it assists college managers to explain to employers the short-medium- and long-term advantage of freeing up staff to become 'dual professionals' (i.e. teach their expertise, validate methods of assessment etc.). By promoting SET careers within their local communities through contributing, whenever possible, to schools' careers events, supporting and sponsoring sporting activities etc., colleges are able to engage with employers as parents and, in the process, create opportunities to convince employers of the value to

them and their families of offering time and access to state-of-the-art industry resources to enhance vocational learning and teaching in colleges.

All the colleges ensure that their SET programmes articulate clearly with local employer needs by 'tailoring' the design and delivery of different courses whenever required. They are able to respond in this way because the principle of *modularisation*, based on the distinction between core and optional modules, underpins English vocational qualifications. Colleges employ a number of strategies to tailor modules to reflect employer needs. One is to agree with employers to include extant optional modules, which have already been accredited by an Awarding Body, to assist learners to develop sector-specific or even company-specific knowledge and skill. Another strategy is for college staff to write new content for extant optional modules or to write a new optional module and have it accredited by an Awarding Body. This strategy is particularly common when colleges are supporting firms or industries that are subject to rapid change and development, especially where IT is a central feature of occupational competence. A third strategy is to diversify the balance between the theoretical content demanded by Level 3 core and optional modules and the practical implications of that content by, ensuring that workshop activity reflects the way in which theoretical content will manifest itself in local industries or, having employers, whenever possible, demonstrate industry practice. This observation anticipates the next boundary crossing activity colleges engage in to ensure their SET programmes articulate clearly with employer and industry needs: the contextualisation of theory and practice.

The challenge of assisting learners to see a relationship, rather than a boundary, between the theoretical and practical elements of their programme of study is a common concern for all vocational, and for that matter professional, courses. The classic reason that seeing a relationship between theory and practice is tricky, as was acknowledged in Section 3.4, is because theory and practice are part of different epistemic traditions: disciplinary (i.e. what follows in accordance with theoretical reasoning) and occupational (i.e. what follows in accordance with practical reasoning)? The pedagogic challenge therefore is to assist learners to appreciate the way in which the former is embedded in the latter, and the latter in ways the former cannot anticipate.

The colleges have all developed a range of slightly different, but ultimately complementary, strategies to contextualise theory and practice. One can be described as colleges' version of the 'school', 'simulation' and 'work' connective vocational learning and teaching spectrum, which was described in Section 3.4. Lecturers start modules by introducing learners to theoretical issues, they follow this up by providing learners with a range of practical activities such as, demonstrations, workshops simulations, videos of occupational practice and encouraging them to look for 'points of connection' between theory and practice, and then encourage learners to consolidate their emerging understanding of the relationship between theory and practice through opportunities to participate in 'scenario' based activities: setting mini projects that require learners to explore, analyse and develop solutions to problems which they have been set. The logic that underpins the school-simulation link can be described as the facilitation of vertical and horizontal development: deepening a learners' understanding of theory and its practical applications.

Colleges engage with the work end of the above spectrum in one of two ways. They offer *work experience* as a way to assist learners, most probably enrolled on NQF (i.e. general) courses, to develop occupationally-relevant knowledge and skill or *work placements* as a way to assist learners, most probably enrolled on QCF (i.e. technical) courses, to develop occupationally-specific knowledge and skill. The former can be offered in a variety of ways – an opportunity to work in the college itself, at a local school or charity or for an employer – and the time period can vary from a few hours per week through to the official European working week of 35 hours. The latter tends to vary according to whether a learner is enrolled on a vocationally-specific course and a college has arranged for them to spend an extended period of time working for a local employer, upwards from one week and over and extended period of time, or an apprentice attending a day/block release at a college.

Colleges use a number of pedagogic strategies to support learners to use work experience and work placements to enhance their theoretical study, for example, regular meetings with employers to agree respective roles and responsibilities (briefings/debriefings etc.) to support learners to move effectively between both contexts, lecturer and line manager observations of learners to either identify where they need additional support or to model how to undertake certain tasks, allocating learners projects which they have to undertake while working by gathering relevant evidence. These strategies extend the logic of vertical and

horizontal development referred to above because, they support learners to begin to think and act as though they were a full-time employee of the firm where they are undertaking their work experience/placement. This subtle, but significant, shift in learners' engagement with the relationship between theory and practice can be described as a *practice-theory* engagement. By this we mean, learners are operating in accordance with either the technical and organizational procedures determined by the firm they are working for and, as a result, are asking themselves how are the theoretical concepts that they have learnt in college embedded in the practical activities they are undertaking, and to what extent does this vary from one situation to another, or by their lecturers introducing theoretical concepts in relation to the technical and organizational characteristics of specific industries. This shift in perspective is the added value of work experience and work placements compared to simulations, because the former position the learner to take on an occupational and organizational identity and think about expertise from that perspective whereas the latter maintains learners with their educational identity and definition of expertise. It is also totally different from the well rehearsed argument about underpinning knowledge; that argument assumes some kind of match between theory and work practice whereas the practice-theory coupling denotes the way in which theoretical concepts by being combined in different ways become part of artefacts and routines in workplaces.

All colleges were aware that learners' practice-theory engagement would flourish more swiftly and extensively in an 'expanded' as opposed to 'restricted' environment. The former type of environment offers learners' access to a workplace culture that has been explicitly designed to both respond to the latest technological developments in the industry and to support staff to do so through well developed knowledge sharing, and learning and development systems. Colleges were nevertheless realistic and accepted that they could not afford to turn down the offer of placements in the latter type of environment and, moreover, sometimes used employer mentors or enterprise schemes as a way to enhancing work experience and offer learners additional opportunities to deepen their occupationally-specific knowledge and skill.

The final dimension of the contextualisation of the relationship between theory and practice is the contextualisation of assessment. The most common ways of accomplishing this goal was to extend the role of dual professionals (DPs) beyond teaching their expertise by having

them co-design assessments with lecturers or involving DPs actively in the assessment process. The benefit to learners is, in the case of the former, that the evidence they produce meets not only the requirements of the Awarding Body, but also is relevant and current to specific occupational areas; and, in the case of the latter, feedback on evidence presented offers learners an opportunity in the college environment to engage with the practice-theory relationship and, in the process, consolidate their occupationally-specific knowledge and skill.

A firm commitment to learner support is also a major theme arising from the case studies. All the colleges appreciate that, irrespective of how well they design and deliver their SET courses, it is vital that they recruit learners to a programme of study commensurate with their capabilities and aspirations, and also that they support learners appropriately through their period of study. Their recognition of this 'beyond the classroom pedagogic role leads colleges to use their websites and social media to promote SET courses within their local communities. One notable development of this marketing strategy has been that some colleges report that they attract learners who live in locations where it would be easier for them to travel to an alternative college. At recruitment events, SET course teams mix displays and demonstrations, information giving, and interviews (often up to one hour long) to both 'match' potential learners to the course that suits them most and also to encourage learners to 'match' themselves to the same course. This mutual matching process plays an invaluable part in creating active, committed, and collaborative SET teaching groups. Apart from allocating learners personal tutors, all the colleges use their VLE systems to provide on-going learning support. Course content is placed on the VLE, as are videos of workshop demonstrations, or classroom-based interactive whiteboard presentations, and videos employers have made available to colleges. These resources can be downloaded by learners thereby enabling them to gain access to resources, which they can, in principle, use to consolidate and further extend their understanding at times suitable to them. For this to happen, however, learners have to feel confident and capable of using these resources. This presupposes that face-to-face learning and teaching sessions, as described above, have assisted learners to develop the confidence to operate in a self-directed way (an example of how one college approaches this challenge is presented in the next section of the report).

6.2. Specific Case Study Issues

There are a number of college-specific issues emerging from the case studies that also involve boundary crossing and which play a major role in facilitating vocational learning and teaching.

One is the development of a future-orientated economic development strategy. This enables colleges to anticipate employers' likely demand for knowledge and skill and to work with them to co-design bespoke courses that meet those demands. There are a number of activities that colleges have to engage in to position themselves to anticipate future demand: attending employer discussion groups and fora and events discussing technological developments in industries that are currently well established in the region a college serves and industries that might relocate to those regions; and, visiting employers on a regular basis to establish strong communication channels about changing skill needs. The major benefit for colleges of participating in these outreach and horizon scanning activities is that they are able to up-skill their existing workforce so lecturers can not only teach on cutting-edge new vocational programmes, but also use the insights they gain from doing so to refresh existing vocational courses.

Another issue is peer observation. The continuous improvement of the quality of learning, teaching and assessment has been a major preoccupation for colleges for many years. One of the most effective ways to embed a culture to support this goal is for colleges to nurture both formal and informal feedback within vocational programme teams as regards the most effective ways to assist learners to engage with learning and teaching activities. Observation and subsequent feedback to college staff is however a process that has to be handled carefully otherwise it could be counterproductive, and especially so as dual professional activity becomes an increasing feature of the delivery of vocational programmes. The establishment of something akin to a 'Licence To Observe' programme in colleges is, arguably, a development that would serve two purposes: develop lecturers' expertise and assist colleges to embed a culture of self-assessment and thereby contribute to their preparation for an OFSTED Inspection.

A further issue is the role of mobile learning in enhancing the quality of learning and teaching. It has become a cliché to state that digital technologies are continually developing and offer educational institutions and learners' innovative resources to enhance learning and teaching.

The critical issue is to identify practical examples of how to derive maximum benefit from such resources. The emergence of the Cloud has rapidly transformed the scope for mobile learning. It has become possible to offer learners' access to educational software, which previously they could only have engaged with in a classroom, and allow them to practice and self-evaluate the development of their knowledge and skills on their own, working informally with peers off-site, and supported by feedback from tutors. The next stage of development is for colleges to work collaboratively with employers and to consider how Cloud-accessed resources can be used to enhance the design and delivery of: a) work experience; and, b) the contribution of dual professionals to vocational learning and teaching.

Finally, the issue of vendor qualifications warrants consideration. Many companies have purchased from firms such as, CISCO, bespoke hardware and software systems. Some colleges have recognised that this creates a dual opportunity for them: to negotiate with CISCO to have their staff trained to run franchised courses at reasonable cost for local employers, especially SMEs, and also to enable staff to prepare students more effectively to make the transition into bespoke IT work environments.

6.3. Vocational pedagogy: an expanded agenda

The cornerstone of the argument presented in this report is that what makes vocational learning and teaching distinctive in general and specifically in the case of SET is that it involves colleges, their staff and their learners in a process of – *continuous boundary crossing* – between sites of learning, relationships between practice and theory etc. Boundary crossing is, as we have seen, a crucial process in facilitating the co-design and delivery of vocational programmes and, in the process, a major contributor to the development of 'skills ecologies' based on interlocking networks of firms, markets and institutions, which Hodgson and Spours (2015) note increasingly characterize dynamic local education-industry (i.e. demand and supply) collaboration.

A number of issues follow from our conclusion about continuous boundary crossing, some of which the report has been able to shed significant light on while others still require further attention. The report has been able, in the case of the former, to:

- re-affirm the importance of employers and colleges leadership to initiate planning, co-designing and, where feasible, co-delivering vocational programmes and, in the process, revealing the importance of defining vocational pedagogy as ways to connect different spheres of learning;
- illustrate the diverse ways that colleges use modularisation to create courses that reflect changing employer demands and by doing so draw attention to the importance of preparing new and experienced members of the teaching profession to learn how to 'tailor' vocational provision;
- introduce a new language of description – *practice-theory* – to enable all parties involved with VLT to think about new ways to support learners to connect theory and practice to one another and, in the process, to overcome the inhibiting legacy of the phrase 'apply theory to practice' in vocational learning and teaching;
- draw attention to the relationship between expansive, compared to restrictive, workplace environments for the outcomes that learners can achieve from work experience and work placements;
- highlight the added value that *mobile* learning as opposed to ICT contributes to the vocational learning and teaching;
- and, finally, identify a range of ways that *employer involvement* with *assessment* allows college to incorporate aspects of the assessment cultures of different occupations and sectors and, in the process, enhance learners occupationally-specific employability skills.

Inevitably, a report based on the interplay between a circumscribed literature review and case studies of best practice vocational learning and teaching from the college-lecturer perspective can only draw attention to, rather than fully explore the above issues. For this reason, the final section introduces a framework that may help College Principals and SET lecturers to implement the co-design and delivery of SET programmes and, over time, nurture the development of local skills ecologies.

6.4. Ways Forward

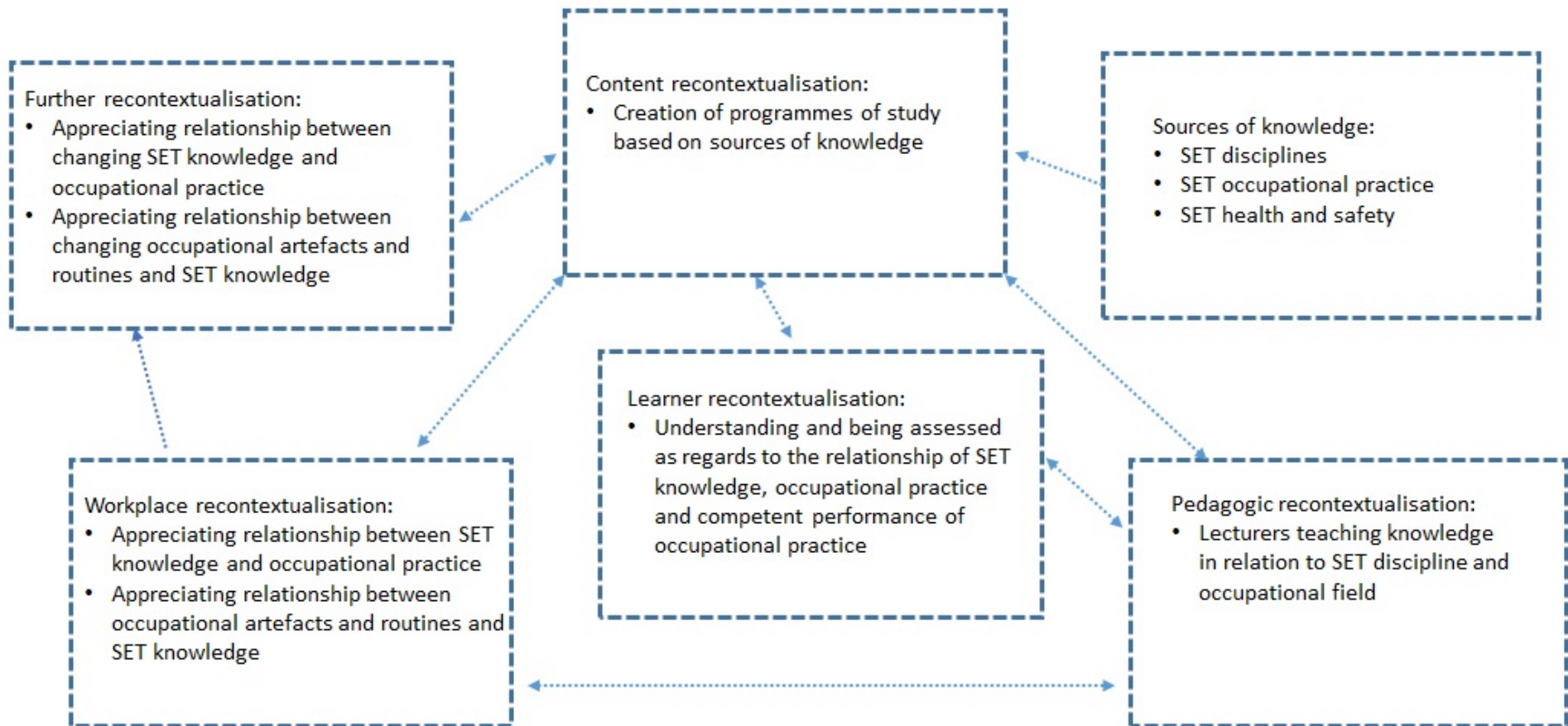
We have noted that the concept of boundary crossing offers a rationale for why vocational learners benefit from work experience, work placements, employer assessment etc. and the benefit for colleges and employers working together to offer learners' access to those experiences. The next step is therefore for colleges, employers etc. to design curricula and pedagogy to facilitate learners' boundary crossing or how to make maximum use of workplaces as environments to support academic and occupational knowledge and skill. The examples of best practice provided in this report mask the challenges that colleges and employers had to address to design their programmes.

One way to approach the challenges associated with boundary crossing is through recourse to the concept of 'recontextualisation' (Guile, 2014) because it offers a unified perspective on the role of: a) lecturers and employers moving knowledge into courses; b) lecturers and employers and learners engaging with that knowledge in college environments; c) employers moving knowledge into practice and workplace artefacts; d) learners encountering knowledge embedded in work routines and artefacts, and e) employers, lecturers and learners engaging with the practice-theory relationship. The diagram below offers a visual representation of the concept of recontextualisation and its implications for SET learners.

Figure 4: Continuous Recontextualisation in SET Programme

(Adapted with permission from Knowledge, Expertise and the Professions, Young, M. & J. Muller (eds) Routledge (2014))

The continuous recontextualisation of SET knowledge and practice



This concept may therefore prove to be helpful by making explicit to new and experienced SET teachers the links that they need to be made between **curricula and pedagogic practice** so that employers can contribute as effectively as possible to the design and delivery of SET programmes and learners derived maximum benefit from those programmes. Moreover, used in conjunction with the practical examples contained in the report, which constitute ‘starters for ten’ sources of inspiration for colleges, lecturers, and employers to revisit their curricula and pedagogic, including ‘dual professional’, practice, the concept and the examples will hopefully result in new examples of excellent vocational teaching and learning to develop the forms of expertise that employers’ require and facilitate learners’ continuing employability.

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