Evidence for Excellence in Education

Report

A Review of Technical Education

National Foundation for Educational Research (NFER)

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A Review of Technical Education

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Contents

Acknowledgements **1**

Executive summary **1**

Introduction 1
Key findings 1
What are the characteristics of technical and vocational education? 1
What makes good technical teaching and learning? 1
How does teaching and learning in technical and vocational subjects differ from the teaching and learning of academic and general subjects? 2
Developing a model for technical teaching and learning 2
Conclusions 3
Recommendations 4
Review aim and methods 5

1 Introduction **6**

1.1 Background 6
1.2 Aim of review and research questions 7
1.3 Review methods 8
1.4 Report structure 8

2 What are the key characteristics of quality teaching and learning? **9**

2.1 Teaching and learning environment 9
2.2 Teaching approaches and learning methods 10
2.3 Teacher attributes and learner relationships 10
2.4 Supporting factors 10

3 What are the characteristics of technical and vocational education? **12**

3.1 Contextualised learning 12
3.2 Diverse nature of learner characteristics and needs 13
3.3 Different approaches 14

4 How is the learning experience different for technical and vocational learners? **16**

4.1 How does teaching and learning differ for technical and vocational learners? 16
4.2 What makes good technical teaching and learning? 17

5 Developing a model for technical teaching and learning **19**

6 Conclusions and recommendations **20**

6.1 Conclusions 20
6.2 Recommendations 21

7 References **22**

Shortlisted studies 22
Other references 23

Appendix A . Review parameters, search strategy and strength of the evidence reviewed 25

Search strategy 25
Bibliographic databases 25
Website searches 31
Breakdown of items reviewed by country 31
Table 1: Items reviewed by country 32
Strength of evidence reviewed 32
Figure 1: Strength of evidence 32

Appendix B Review template 33

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Executive summary

Introduction

There is a substantial body of evidence and opinion which supports the case for strengthening the UK's technical and vocational education system. Understanding the meanings, characteristics and implications of vocational, technical and professional education will help to inform the discourse across the education, training and business sectors to improve technical skills provision and productivity.

Key findings

The evidence reviewed reveals the definitional challenges of a lack of universal understanding of what is meant by 'vocational', 'technical' and 'professional' education. It points to clarity in terms of what constitutes effective *vocational* teaching and learning but does not provide enough evidence to identify the components of effective *technical* education.

What are the characteristics of technical and vocational education?

One of the main characteristics of vocational education is how the teaching and learning relates to the workplace or is contextualised in the selected area of work or occupation. The context defines the nature of the learning that takes place and includes contextualising the content of the course and the pedagogic approaches. This includes the workplace and ensures that the learner makes sense of their learning.

Vocational education is also characterised by the diverse nature of the learners taking the courses in terms, for example, of their different educational, occupational and skills backgrounds. Additionally, there is some evidence that vocational courses are characterised by different approaches to issues affecting assessment and to the vocational pedagogy teachers and trainers draw on to inform the teaching methods they use.

What makes good technical teaching and learning?

Bearing in mind the caveat highlighted above that there is not enough evidence to comment specifically on the components of effective *technical* education, it is only possible to draw out what makes good *vocational* teaching and learning. The fundamentals (that apply to *all* teaching and learning) include: a calm, well-disciplined and orderly learning environment; a culture of aspiration and achievement for all learners; purposeful and stimulating teaching; outlining what is expected of learners in terms of their behaviour; developing shared respect; learning support that is adaptive to the needs of learners; interactive approaches to teaching; fostering positive relationships between teachers and learners; and teachers having strong subject knowledge and confidence in their own ability.

However, the important additional element of effective vocational teaching and learning is the contextualisation of learning to the workplace or occupation that the learner either works in or aspires to work in. The Commission on Adult Vocational Teaching and Learning (2013) identifies the key characteristics of excellent vocational teaching as:

1. a clear line of sight to work on all vocational programmes
2. 'dual professional' teachers / trainers who combine professional and pedagogical expertise, are trusted and given the time to develop partnerships and curricula with employers
3. access to industry-standard facilities and resources
4. clear escalators to higher-level vocational learning, developing and combining deep knowledge and skills.

This suggests that vocational learning requires a substantial degree of sequencing of learning with contextualisation representing the critical layer.

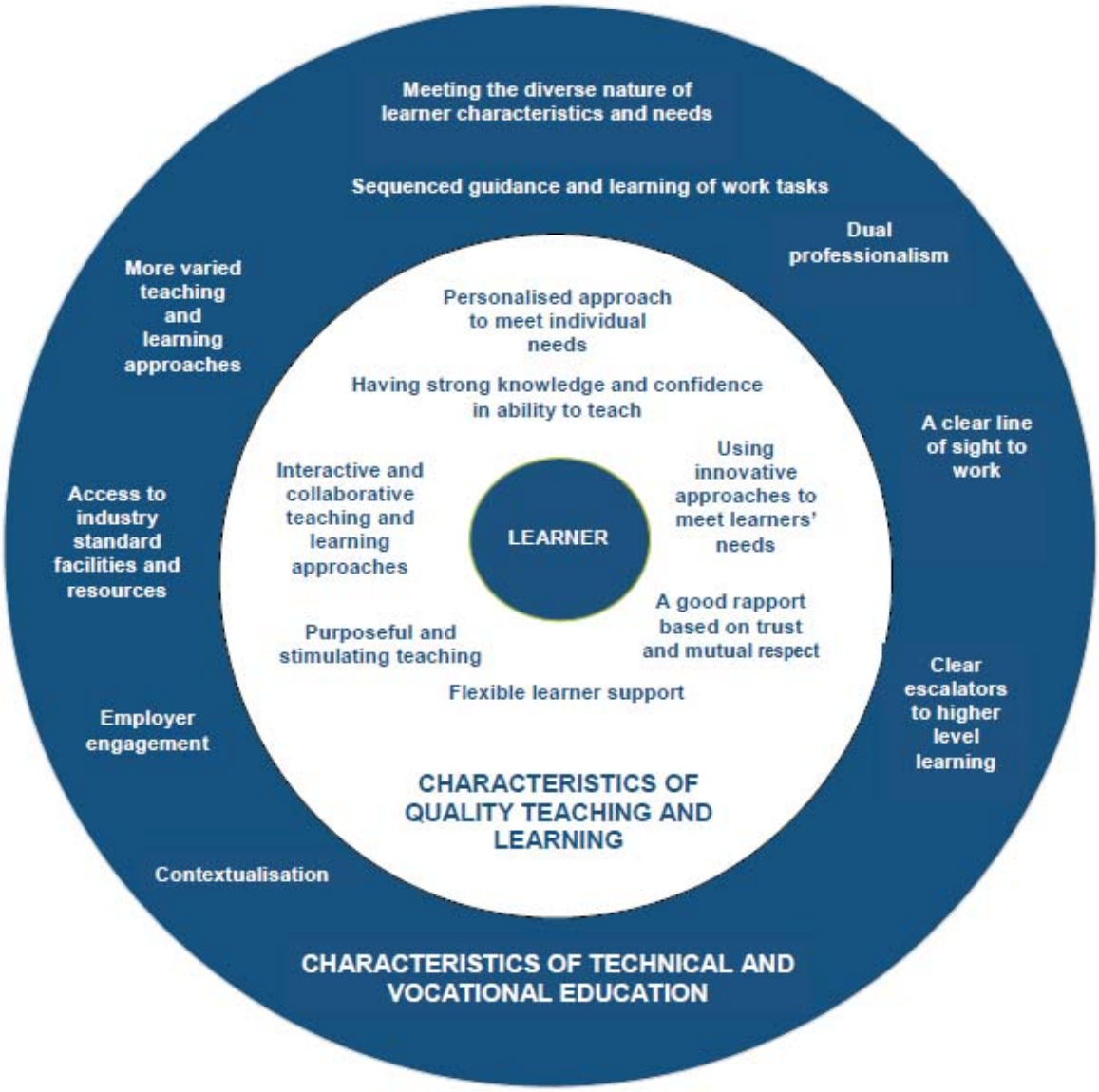
Additionally, effective vocational teaching and learning is most effective when teachers and trainers acknowledge that each learner is different and it is important to meet the needs of this diverse range of learners in order to prepare them for the workplace.

How does teaching and learning in technical and vocational subjects differ from the teaching and learning of academic and general subjects?

The evidence indicates that teaching and learning in vocational subjects is different from their more academic counterparts. In essence, the characteristics identified in the Commission on Adult Vocational Teaching and Learning report (2013) reflect the need for contextualisation of learning in technical and vocational subjects and highlight, in particular, the need for teachers and trainers to be informed by up-to-date industry experience and knowledge of current practice; to provide clarity in terms of links with learners' future occupations; and to draw on appropriate learning provision in terms of learning environments and correct sequencing of guidance and learning of work tasks.

Developing a model for technical teaching and learning

Drawing on the literature reviewed, we developed a model (below) to assist understanding of technical teaching and learning. The model places learners at the centre as they are the primary recipients and beneficiaries of teaching and learning. The characteristics of quality, general and academic teaching and learning form the first ring of provision for two reasons. Firstly, learners are exposed to general and academic teaching and learning in their primary and secondary school education, which helps to prepare them for further education and training including technical and vocational education. Secondly, technical and vocational education draws on the fundamentals of general and academic teaching and learning. The second ring of provision presents the characteristics of technical and vocational education. , As the review evidence did not attribute exclusive properties to technical education, the model does not differentiate technical from vocational education.



Conclusions

This review found limited literature referring specifically to technical education, which is an under-researched area of education provision. Technical education is not generally defined as a separate entity as distinct from vocational education.

The review evidence indicates that *all* learning benefits from a calm, well-disciplined learning environment; a culture of aspiration and achievement for all learners; and purposeful and stimulating teaching. Furthermore, learner engagement and an interactive teaching and learning process, underpinned by supportive teacher/trainer-learner relationships, are fundamentally important. Effective teaching and learning also requires teachers with strong subject knowledge and confidence in their own subject ability. All teaching should meet the diversity of learners and their needs. The evidence suggests that technical and vocational

learners' needs are even more diverse so teachers and trainers need to be more aware of how to meet them.

The evidence highlights that the characteristics of vocational education include not only those associated with all learning, but also the distinctive, additional feature of contextualisation. This vital feature means that effective vocational teaching and learning need to relate to the workplace or be contextualised in the selected area of work, occupation or business sector relevant to the course. Contextualisation broadly includes a clear line of sight to work, access to industry-standard facilities and resources, and the benefits of teachers' dual professionalism (combined expertise in subject knowledge and pedagogy) and the sequencing of experiences. We suggest that this also applies to technical education.

The emphasis on contextualised learning and the diverse nature of learners studying vocational courses may explain why a number of authors observe the need for different approaches to teaching and learning. For example, in terms of pedagogy, the evidence supports the importance of continuing professional development (CPD) for teachers and trainers. This can extend their range of learning methods for vocational education and help ensure that they remain up-to-date with current practice in the sector in which they teach. Additionally, it is crucially important that teachers/trainers and/or institutions have the time to build and maintain ongoing relationships with employers and sector bodies. This enables teachers and trainers to be part of a community of practice where pedagogy fits with workplace practices and helps to ensure that provision meets the needs of employers.

Another example of the need for different approaches to vocational teaching and learning, highlighted in the literature, is assessment of work-related skills. Assessment of vocational learning can be complex because, for example, it can be carried out by supervisors in the workplace as well as by college staff. Achieving a balanced assessment of technical competencies in addition to 'higher-order' learning outcomes and soft/generic competencies is a challenge.

Recommendations

As further education (FE) colleges are currently one of the main providers of technical education, they are in a pivotal position to take forward the development of technical education, which is increasingly recognised as making an important contribution to the UK's productivity and economic growth. In order to further develop colleges' capacity and capability, we recommend that the AoC considers:

- undertaking an audit of their members to ascertain present capacity and capability to deliver further technical education at Levels 3,4 and 5
- sharing examples of good practice in providing technical education, including drawing on expertise from the forthcoming institutes of technology
- leading discussions about how best to ensure that staff can maintain and update their knowledge, skills and expertise in their employment / business sectors.

We also recommend that there is a need to develop a more detailed understanding of technical education teaching and learning building on the work of the Commission on Adult

Vocational Teaching and Learning (2013) and reflecting current commentary on professional and technical education.

We believe that these actions would help the FE sector to meet the growing technical education challenge.

Review aim and methods

The Association of Colleges (AoC) considered that it was timely to sponsor research to contribute to the discourse on shaping the future development of technical and vocational education. AoC commissioned the National Foundation for Educational Research (NFER) to undertake a rapid literature review to identify the key characteristics and essential elements of teaching and learning in technical and vocational education. This small-scale review, carried out between July and September 2015, examined the characteristics of technical and vocational education highlighting what makes good technical teaching and learning, and how this differs from teaching and learning in general, more academic areas..

We undertook systematic searching based on a consistent, best evidence approach to the selection of the literature. The criteria for selection were:

- Texts published in the English language in the United Kingdom, Australia, Canada and the USA, from 2010 to present.
- Texts exploring the key characteristics and essential elements of teaching and learning in technical and vocational education for students aged 16 and above.

A range of bibliographic databases and websites of key organisations and institutions were examined to ensure coverage of the evidence base.

In total, 98 items were identified during the searches. Each item was screened for relevance, with items selected based on their relevance to the research questions and the quality of the evidence. Twenty-seven items were shortlisted for consideration. A further ten items were removed from the shortlist because they fell outside the scope of the countries of interest, did not answer the research questions or the quality of the evidence was poor. The remaining 17 items were reviewed using an appraisal template which summarised findings under key headings related to research design, key findings in relation to the research questions, and relevance.

1 Introduction

1.1 Background

There is a substantial body of evidence and opinion which supports the case for strengthening the UK's technical and vocational education system. The OECD 'Skills Beyond School' in England report (Musset and Field, 2013) identified several challenges: a lack of technical and vocational provision at post-secondary level in comparison with many other countries, and relative to potential demand; limited employer engagement; variable use of workplace training; and no systematic quality assurance. Bhattacharya (2015) observed that the neglect of technical education over several decades adversely affects our productivity and makes the UK less competitive in the global market place.

The Association of Colleges (AoC) 'Breaking the Mould' paper (2014) highlighted the continuing decline of higher technical and vocational education (Levels 3 to 5) as evidenced, for example, by the shortage of trained technicians which is a problem for industrial and service sectors. Kelly (2015) noted that employers in sectors requiring high-level technical skills, such as telecommunications, vehicle maintenance and repair, and mechanical engineering, 'face significant skills gaps resulting from incomplete technical skills' (p.7). Attributing this problem to the 'gravitational pull' towards academic courses and the lack of technical and vocational education provision owing to current systems for validating, awarding and funding courses, the AoC advocates that action should be taken to '[...] address the imbalance between higher technical and vocational education and traditional academic provision. Failure to do so will threaten sustained economic recovery and risk undermining the prosperity and economic fulfilment of both young and old' (p.3).

In its follow-up paper, *How to Build on Breaking the Mould: Next Steps*, the AoC (2015) made the case for developing a new validation and accreditation model to meet the technical education challenge. It proposed the creation of 'a new Technical Education Accreditation Council that will accredit institutions, whether universities, colleges or training providers, to award flexible and short cycle technical education awards at Levels 3, 4 and 5 and at different lengths of study' (p. 9). The principles underpinning the Council include employer leadership in setting standards for awards; robust, transparent and appropriate internal and external quality assurance procedures; and adoption of teaching and learning techniques appropriate to technical education. The AoC envisages that further education (FE) colleges would be the majority of accredited institutions, because of their expertise in providing Level 3 courses and experience of providing technical and professional part-time courses.

The key role of FE colleges in addressing the deficit in higher-level technical and professional skills is endorsed by Kelly (2015) who asserts that:

> *The further education (FE) sector is ideally placed to play a larger role in the provision of technical and professional qualifications but expansion must be dependent on links to local employers and on teaching that combines pedagogical expertise with knowledge of current practice in the workplace.*
>
> (p. 8)

Most delegates attending a recent seminar on professional and technical education also considered that FE colleges are the 'prime provider' of this type of education as they have 'a strong engagement with employers' (BIS and Centre for Vocational Education Research, 2015, p. 2).

Growing a system of employer-led professional and technical qualifications is central to the Government's plan to improve the UK's productivity which compares unfavourably with many OECD countries. *Fixing the Foundations: Creating a More Prosperous Nation* (HM Treasury, 2015) sets out several reforms to achieve this, including the funding of three million high-quality apprenticeships and creating a network of Institutes of Technology, focussed on the higher-level skills employers require. The OECD (2015) *Skills Outlook 2015: Youth, Skills and Employability* identified job and occupational skills – technical skills – demanded by employers, as an important component of the range of skills that young people need to make a successful transition from education to employment. As the report acknowledges, the acquisition and application of skills are important for driving socio-economic progress and underpinning individual well-being: 'Individuals need a multiplicity of skills to achieve diverse life goals' (p. 22). These skills include cognitive skills (interpreting and applying complex information), social and emotional skills involved in working with others, and creativity and critical thinking as well as technical skills.

As detailed above, there is a powerful rationale for transforming the UK's professional, technical and vocational skills base. This endeavour would benefit from achieving some clarity on the definition and meaning of 'professional', 'technical' and 'vocational' education. These terms are often used interchangeably and are interpreted through different lenses. Understanding the meanings, characteristics and implications of these terms will help to contribute to the discourse on shaping the future development of technical and vocational education.

1.2 Aim of review and research questions

The AoC commissioned the National Foundation for Educational Research (NFER) to undertake a rapid literature review in order to identify the key characteristics and essential elements of teaching and learning in technical and vocational education. This small-scale review was carried out between July and September 2015.

The research questions below framed the review.

- What are the characteristics of technical and vocational education?
- What makes good technical teaching and learning?
- How does teaching and learning in technical and vocational subjects differ from the teaching and learning of academic and general subjects?

These are the research questions the review was aiming to explore. However, the items reviewed are clear about the terms of what constitutes effective *vocational* teaching and learning but do not provide enough evidence to comment on the components of effective *technical* education. For example, Unwin (2015) discusses vocational education and training (VET) definitions and notes that in the United States, the preferred term is 'career and

technical education', whereas European countries tend to use the term 'vocational education' (p. 6-7). This points to a lack of universal coherent understanding of what the terms mean.

'*Fixing the Foundations: Creating a More Prosperous Nation* (HM Treasury 2015) states that: 'Professional and technical education provision, of which the majority is currently at Level 2 and below, needs to be refocused to deliver the higher-level skills that employers need' (p. 25). We suggest that this refocusing needs to include clarity on the differences between vocational and technical teaching and learning.

1.3 Review methods

We undertook systematic searching based on a consistent, best-evidence approach to the selection of the literature. The criteria for selection were:

- Texts published in the English language in the UK, Australia, Canada and the USA, from 2010 to present.
- Texts which explore the key characteristics and essential elements of teaching and learning in technical and vocational education for learners aged 16 and above.

A range of bibliographic databases and websites of key organisations and institutions were examined to ensure coverage of the evidence base. See Appendix A for full details of the search strategy.

In total, **98 items** were identified during the searches, each of which was then screened for relevance. Items were selected based on their relevance to the research questions and the quality of the evidence (for example, evidence based on a fairly large mixed methods approach or a large qualitative study would have been selected over one case study or an opinion piece). Twenty-seven items were shortlisted for consideration by the AoC and the research team. An additional ten items were removed from the shortlist following further scrutiny because they fell outside the scope of the countries of interest, did not answer the research questions or the quality of the evidence was poor. Therefore, a total of **17 items** were included in the review (see Chapter 6 for the full list of references). The 17 items were reviewed using an appraisal template which summarised findings under key headings related to research design, key findings in relation to the research questions, and relevance (see Appendix B for the template).

1.4 Report structure

The report examines the research questions firstly from the perspective of the key messages from the evidence on the key characteristics of teaching and learning across all types of education, not just technical and vocational education (Chapter 2). We then discuss the key characteristics of technical and vocational education in Chapter 3. Chapter 4 explores how teaching and learning is different for technical and vocational learners and reflects on what makes good technical teaching and learning. In Chapter 5, we develop a model for technical teaching and learning. The final chapter of the report presents the conclusions from the review and recommendations for the AoC.

2 What are the key characteristics of quality teaching and learning?

In this chapter we summarise the key characteristics of quality teaching and learning which apply across *all types* of education (i.e. general, academic, vocational and technical). We discuss the teaching and learning environment, teaching approaches and learning methods, teacher attributes and learner relationships, and supporting factors.

2.1 Teaching and learning environment

When Rowe *et al.* (2012) carried out a literature review to examine what 'good teaching' looks like, they identified a number of features related to the teaching and learning environment including:

- a calm, well-disciplined and orderly learning environment
- a culture of aspiration and achievement for all learners
- purposeful and stimulating teaching.

The authors reported the importance of the learning environment offering safety and security to learners. Another finding was that outlining what is expected of learners in terms of their behaviour and developing shared respect can have a positive impact on learners' confidence and willingness to learn. Black and Yasukawa's (2013) study into quality teaching in vocational education and training also identified respect as an enabling factor of good teaching.

Rowe *et al*. (2012) highlighted the importance of creating a culture where learners are encouraged to reach their aspirations and achieve and are supported in their learning. Their review showed that smaller class sizes can facilitate teaching and learning focused on the needs of individual learners and can be particularly useful for lower-achieving groups. Their review also found that developing a purposeful and stimulating teaching environment is essential for effective teaching. This includes creating a classroom that is welcoming and provides bright and informative displays of learners' work. These environmental factors can help increase learner motivation by fostering a sense of achievement.

Placklé *et al.'s* (2014) research into learning environments identified learning support that is adaptive to the needs of learners as an important characteristic of quality teaching and learning. They identified an effective learning environment as one which offers flexibility and support, whilst at the same time ensuring that tasks are '[...] challenging and attractive both on an individual and collective level' (p.112).

2.2 Teaching approaches and learning methods

The review by Rowe *et al*. (2012) found that interactive approaches help facilitate effective teaching. Collaborative learning via group work had a positive impact on learners' problem-solving and social skills. Fletcher *et al.'s* (2012) research into teaching strategies used in career and technical education identified problem-based learning and discussion-based activities amongst those strategies commonly used by teaching staff. The latter was positively associated with increased learner motivation and engagement.

Other key characteristics of quality teaching and learning included:

- a collaborative approach to learning between learners and teachers, including an open dialogue to help facilitate independent thinking; learner involvement in setting targets; and 'teachers drawing on the strengths of learners and treating them fairly (Moodie and Curtin, 2010)' (Black and Yasukawa, 2013, p. 44)
- meeting the needs of individual learners through a personalised approach
- making effective use of external experts coming into the institution.

2.3 Teacher attributes and learner relationships

The evidence noted the importance of fostering positive relationships between teachers/trainers and learners as a key characteristic of quality teaching and learning (Faraday *et al*., 2011; Rowe *et al*., 2012). This includes getting to know learners in order to help identify the level of support needed; establishing a good rapport; and developing trust and mutual respect which, in turn, can have a positive impact on learner behaviour, for example.

Rowe *et al.* (2012) found that having strong subject knowledge and confidence in one's own ability are essential teacher attributes. In addition, adopting innovative approaches to meet the needs of learners can facilitate effective teaching (for example, changing the setting being used to teach learners). Benefits include increased teacher motivation and a more positive perception of the learning experience amongst learners.

2.4 Supporting factors

The literature identified factors which are critical to supporting the teaching and learning process. Rowe *et al*. (2012) found that strong leadership, centred on improving standards and outcomes for learners, is key to success. Other supporting factors identified by their review included developing a whole-institution ethos which facilitates a positive experience for learners, and developing a culture where the learner voice is valued and learners feel that they are listened to.

Another supporting factor was enhancing professional practice, through teachers' reflection on the effectiveness of their teaching practice (Faraday *et al*., 2011; Rowe *et al*., 2012). Faraday *et al*. (2011) noted that good teachers are those who:

> [...] *are always learning, building their own skills and teaching themselves. They undertake lots of research to inform their planning and delivery. They are self-critical, recognising when things do not go well, trying to understand why and formulating ideas about how to improve.*
>
> (p. 48)

Regardless of the type of education, technical, vocational, academic and general education all aim to maximise learning from work placements and employer engagement and address learner diversity (such as socio-economic status, gender and language).

The literature indicated that quality education offers clear progression to further study or employment. This includes equipping learners with the relevant skills and attitudes to enable them to gain employment and perform effectively in the workplace. For example, the Commission on Adult Vocational Teaching and Learning (CAVTL) (2013) argued that, for teaching and learning to be excellent, there need to be 'clear escalators to higher-level vocational learning, developing and combining deep knowledge and skills' (p. 9).

The following section discusses the key characteristics of technical and vocational education. In reading this section, it should be noted that most of the discussion in the reviewed literature focused on vocational education. We found little evidence of characteristics unique to technical education.

3 What are the characteristics of technical and vocational education?

While some (seven) of the reviewed items discussed characteristics associated with the quality of overall teaching and learning strategies, nine specifically examined elements of the characteristics of vocational and technical education.. It should be noted that in most cases the evidence refers to vocational education.

3.1 Contextualised learning

Nine of the reviewed items identified one of the main characteristics of technical and vocational education to be either relating learning to the workplace, or contextualising the learning and teaching in the selected area of work or occupation on which the course concentrates (Fletcher *et al.,* 2012; Placklé *et al.,* 2014; Mackaway *et al.,* 2011; Lucas and Spencer, 2015; Faraday *et al.,* 2011; Commission on Adult Vocational Teaching and Learning, 2013; Schaap *et al.,* 2011; Simmons, 2014; Taylor *et al.,* 2010).

Simmons (2014) highlighted the importance of learners being able to apply what they learn to the context in which they work and understand the relevance of the knowledge that they are acquiring to the workplace. The author cited four types of contextualisation:

1) content recontextualisation (the programme design environment)
2) pedagogic recontextualisation (the teaching and facilitating environment)
3) workplace recontextualisation (the workplace)
4) learner recontextualisation (the learners making sense of the whole).

These different elements of contextualised learning suggest that contextualising the teaching and learning in a meaningful way for the learner is a particularly important aspect of technical and vocational education. Indeed, Faraday *et al.'s* (2011) study on effective teaching and learning in vocational education found little evidence to suggest teaching and learning differ by the type of education, apart from in its context. The authors suggest that, in terms of identifying effective teaching and learning strategies, teaching context should be added to other core elements (teaching relationships; teaching skills; teaching models; and teacher reflection). The report argued that context warrants separate consideration as it is such an important factor in vocational learning. Context defines the nature of the learning that will take place. According to the authors, it includes the learning setting, and is also a broader concept, including:

> *the learning objectives and desired outcomes for a session or part of a session; the nature of the learning such as the vocational subject area, and whether it is theoretical or practical; the level of the learning; the specification and*

> *requirements of the qualification or course; the nature of the learners, how they learn best including their learning styles…or any particular difficulties they might have in learning; the composition and size of the group of learners and the learning environment including the resources and facilities available.*
>
> (p. 55)

The broader concept of context outlined here clearly includes other integral elements, such as the nature of the learners and qualifications / assessment requirements (discussed in sections 3.2 and 3.3 below), and facilities and resources (discussed in Chapter 2 and section 4.2). But the context in which vocational learning takes place, and/or the workplace the learning applies to, is critically important. This suggests that vocational (and technical) learning requires a substantial degree of sequencing of learning, with contextualisation representing the critical layer.

Placklé *et al.*'s (2014) study, which sought to identify learner preferences with regard to learning environments in vocational education (referred to as 'powerful learning environments'), highlighted that learners preferred learning tasks that challenged them and were 'authentic' (p. 110), that is, focussed on the real world. While the focus of Mackaway *et al.*'s (2011) study was to synthesise literature on the assessment of learning in areas such as work-integrated learning (see section 3.3), this report also observed that some of the primary purposes of learning through participation are to acquire employability or work skills and the integration of theory and practice.

3.2 Diverse nature of learner characteristics and needs

Commentary from four studies (Tran and Nyland, 2013; Fletcher *et al.*, 2012; Moraitis *et al.*, 2012; Billett *et al.*, 2012) suggested that vocational education is also characterised by the diverse nature of the learners taking the courses.

Moraitis *et al.*'s (2012) action research study, which focused,on Australian Vocational Education and Training (VET) diplomas of Community Services and Community Development, pointed out that learners come from very diverse backgrounds:

> *VET teachers are acutely aware of, and sometimes daunted by, the distance these learners must travel in order to succeed in their VET diploma course, to take up expanding opportunities to enter Higher Education and to work constructively in the field.*
>
> (p. 58)

Fletcher *et al.* (2012) commented, in their study on career and technical education (CTE) in the United States, that challenges include meeting the needs of all learners from different backgrounds. They observed that teachers within the CTE sector come from less diverse backgrounds than their learners:

> *This gap between the backgrounds and cultural experiences of faculty and their learners creates a cultural mismatch and often at times is considered to be a primary factor in the exacerbation of the existing academic achievement gap, particularly between White and African American learners.*
>
> (p. 69)

The emphasis on contextualised learning and the diverse nature of learners studying vocational courses may explain why a number of authors observed the need for different approaches to teaching and learning.

3.3 Different approaches

There was some evidence that different teaching and learning approaches are used to meet the needs of the diverse range of vocational learners and to prepare them for the workplace. The following examples include approaches to vocational pedagogy and the challenges of assessment:

Vocational pedagogy

Lucas and Spencer's (2015) study on how to teach vocational education asserted that, in order to improve the quality of teaching and learning, it is important to have a better and more nuanced understanding of pedagogy – the choices which teachers and trainers take about learning methods with the learners they teach. The authors provided examples of a range of learning methods which teachers and trainers can select including: learning from experts; deliberate practising; hands-on learning; feedback which promotes learning; real-world problem solving; one-to-one coaching and mentoring; competing against the clock; and seamless blending of online and face-to-face learning.

Black and Yasukawa (2013) noted the importance of teachers and trainers being part of a community of practice where pedagogy fits with workplace practices of the jobs that learners want to take up.Kelly (2015) made the case for 'facilitating a 'community of practice' between industry and the FE sector that helps to ensure provision meets the needs of employers' (p.32).

The Commission on Adult Vocational Teaching and Learning (2013) identified eight distinctive features of vocational pedagogy:

1. developing occupational expertise through sustained practice and understanding theory
2. having work-related attitudes (central to developing occupational expertise)
3. using practical problem-solving and critical reflection on experience
4. developing collaborative and contextualised teaching, involving different types of 'teacher'
5. keeping on top of technological developments
6. using assessment and feedback methods involving teachers and learners

7. benefitting from operating across more than one setting including a real or simulated workplace
8. having dynamic occupational standards which evolve to reflect advances in work practices.

Assessment

Mackaway *et al.* (2011), in their study on learning through participation, identified a range of themes and issues affecting assessment in areas such as work-integrated learning. These included:

(1) Determining what aspect of learning to assess

The study cited authors that warn of the over-reliance on assessing technical competences at the cost of 'higher-order' learning outcomes, and of assessing the more tangible and identifiable technical competences compared to soft / generic competences which are harder to measure.

(2) What evidence can be used

The range of variables and issues specific to each context influences whether assessment should be based on the product of learning, the actual practice of a skill or competency, or the process of learning.

(3) Verification of learning

The authors stated that different assessment methods do not assess real-world skills and learning outcomes to the same extent. They identified challenges which included: deciding who determines learning outcomes and assessment criteria; developing appropriate assessment criteria; articulating competences which address implicit knowledge; ensuring consistent interpretation and application of standards/criteria; capturing unintended learning outcomes; and determining whose priorities set standards (industry / university / community or a combination of these).

(4) The role of the host supervisor

This study defined the host supervisor as the person within the work placement organisation responsible for supervising the learner. Host supervisors often develop, support and validate learner achievement of learning outcomes, including through assessment. Problems arise when the host supervisor has the dual role of mentoring and assessing learners, especially when learners are underperforming.

(5) Reliance on reflection

The authors pointed out that there is little research into the links between reflection and learning through participation, even though reflection is used extensively to support learning and assessment, especially in courses where there is a need to connect field experience with university learning (e.g. nursing, teaching, psychology).

These features of vocational pedagogy and assessment provide an indication of some of the challenges inherent in the provision of effective vocational and technical education.

4 How is the learning experience different for technical and vocational learners?

In this chapter we consider how the learning experience is different for technical and vocational learners (in contrast to general or academic courses) and what makes good technical and vocational teaching and learning.

4.1 How does teaching and learning differ for technical and vocational learners?

The evidence points to vocational learners experiencing learning in a different way from their peers studying more academic courses. These differences are consistent with the characteristics of excellent adult vocational teaching put forward by the Commission on Adult Vocational Teaching and Learning (2013) (see section 4.2) and, in essence, reflect contextualisation of learning. The following examples provide illustrations of how technical and vocational learners should experience those differences:

a) Teachers should be informed by up-to-date industry experience and knowledge of current practice

Kelly's (2015) study on raising productivity by improving higher technical education, observed the importance of education providers engaging with employers, and teachers and trainers having up-to-date industry experience and knowledge of current practice in their occupation. Guile's (2015) paper reported that one of the elements of a technical apprenticeship in the creative and cultural sector designed for aspiring entrants that made it successful was a project coordinator who worked in the theatre and had extensive knowledge and experience in training and development.

b) Teachers should provide clarity in terms of links with learners' future occupation

Black and Yasukawa (2013) in their study 'Disturbing the pedagogical status quo: Language, literacy and numeracy and vocational teachers working together', noted the importance of pedagogy fitting with workplace practice in the jobs that learners want to progress to.

Lucas and Spencer (2015) noted that one of the three key features of apprenticeships is 'on-the-job' and 'off-the-job' learning. They define on-the-job to mean learning at the workplace (activities such as training; placements; mentoring; attending trade shows; visits; competitions; manufacturer training) and off-the-job to mean learning at college or with the learning provider.

c) Effective teaching and learning should draw on appropriate learning provision

Vocational education is enhanced by drawing on different learning environments, such as school, college and workplace contexts, according to Schaap *et al.* (2011). The authors observed that learners' integration of knowledge, skills and attitudes is enhanced in 'hybrid' situations offering 'a specific and unique learning environment which combines relevant and effective components of vocational schools and workplaces' (p.113).

Billett *et al*. (2012), in their study on continuing education and training models, concluded that guidance at work, augmented by practice, was consistently identified by adult workers as their most significant form of learning. They prefer and value learning that occurs through authentic activities and is delivered by co-workers:

> *The three most frequent forms of preferred strategies for supporting learning were Working and sharing with another person on the job (77%), Direct teaching by a workplace expert (67%), and Group activities in a classroom, guided by a trainer or facilitator (55%).*
>
> (p. 26)

Additionally Billet *et al.* (2012) highlights the need for organisation and 'a sequence of experiences with gradually decreasing levels of guidance' (p. 37) and indicates that learners have to meet certain regulations to progress.

4.2 What makes good technical teaching and learning?

Bearing in mind earlier caveats that the items reviewed did not make explicit reference to technical education, this section reflects on what the evidence says about good vocational teaching and learning.

In addition to the key characteristics of quality teaching and learning for all forms of education (see Chapter 2), the evidence indicates that contextualisation (see Chapter 3) is essential for effective vocational teaching and learning.

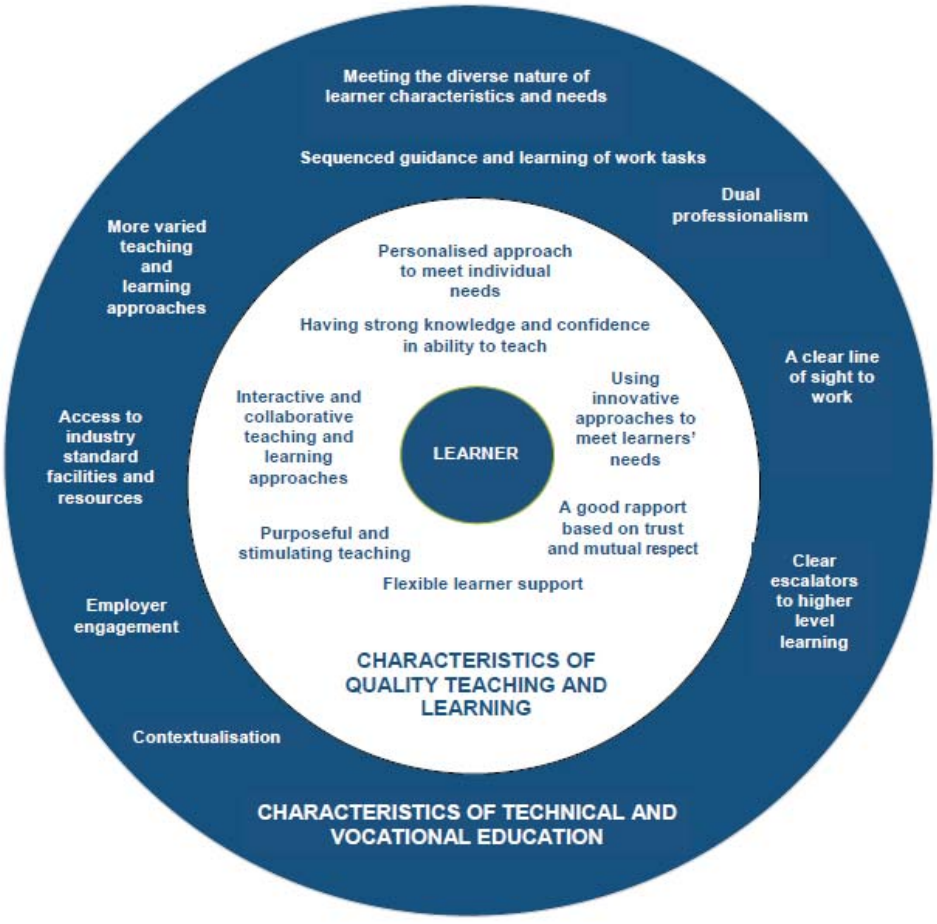
In addition, the seminal report from the Commission on Adult Vocational Teaching and Learning (2013) identified four characteristics of excellent adult vocational teaching:

1. a clear line of sight to work on all vocational programmes
2. 'dual professional' teachers / trainers who combine professional and pedagogical expertise, are trusted and given the time to develop partnerships and curricula with employers
3. access to industry-standard facilities and resources
4. clear escalators to higher-level vocational learning, developing and combining deep knowledge and skills.

Although clearly focussed on *adult* vocational teaching and learning, we suggest that these characteristics apply equally to vocational teaching and learning for 16- to 19-year-olds and to technical education.

5 Developing a model for technical teaching and learning

Drawing on the literature reviewed, we have developed a model (below) to assist understanding of technical teaching and learning. The model places learners at the centre as they are the primary recipients and beneficiaries of teaching and learning. The characteristics of quality general and academic teaching and learning form the first ring of provision for two reasons. Firstly, learners are exposed to general and academic teaching and learning in their primary and secondary school education which helps to prepare them for further education and training including technical and vocational education. Secondly, technical and vocational education draws on the fundamentals of general and academic teaching and learning. The second ring of provision presents the characteristics of technical and vocational education. These include distinctive features such as contextualised learning, having a clear line of sight to work, teacher and trainer dual professionalism and use of industry-standard facilities, and resources. As the review evidence did not attribute exclusive properties to technical education, the model does not differentiate technical from vocational education.



6 Conclusions and recommendations

There is a substantial body of evidence and opinion which supports the case for strengthening the UK's technical and vocational education system. Understanding the meanings, characteristics and implications of vocational, technical and professional education will help to inform the discourse across the education, training and business sectors to improve technical skills provision and productivity.

6.1 Conclusions

This review found limited literature referring specifically to technical education, which is an under-researched area of education provision. Technical education is not generally defined as a separate entity as distinct from vocational education.

The review evidence indicates that *all* learning benefits from a calm, well-disciplined learning environment; a culture of aspiration and achievement for all learners; and purposeful and stimulating teaching. Furthermore, learner engagement and an interactive teaching and learning process, underpinned by supportive teacher / learner relationships, are fundamentally important. Effective teaching and learning also requires teachers with strong subject knowledge and confidence in their own subject ability. All teaching should meet the diversity of learners and their needs. The evidence suggests that technical and vocational learners' needs are even more diverse so teachers and trainers need to be more aware of how to meet them.

The evidence highlights that the characteristics of vocational education include not only those associated with all learning, but in addition the distinctive, additional feature of contextualisation. This vital feature means that effective vocational teaching and learning need to relate to the workplace or be contextualised in the selected area of work, occupation or business sector relevant to the course. Contextualisation broadly includes a clear line of sight to work, access to industry-standard facilities and resources and the benefits of teachers' and trainers' dual professionalism (combined expertise in subject knowledge and pedagogy) and the sequencing of experiences. We suggest that this also applies to technical education.

The emphasis on contextualised learning and the diverse nature of learners studying vocational courses may explain why a number of authors observe the need for different approaches to teaching and learning. For example, in terms of pedagogy, the evidence supports the importance of continuing professional development (CPD) for teachers and trainers. CPD can extend their range of learning methods for vocational education and enables them to be completely up-to-date with current practice in the sector in which they teach. This will enable them to meet the requirements of their dual professionalism. Additionally, it is crucially important that teachers/trainers and/or institutions have the time to build and maintain ongoing relationships with employers and sector bodies. This enables teachers and trainers to be part of a community of practice where pedagogy fits with workplace practices.

Another example of the need for different approaches to vocational teaching and learning, highlighted in the literature, is assessment of work-related skills. Assessment of vocational learning can be complex because, for example, it can be carried out by supervisors in the workplace as well as by college staff. Achieving a balanced assessment of technical competencies in addition to 'higher-order' learning outcomes and soft/generic competencies is a challenge.

6.2 Recommendations

As FE colleges are currently one of the main providers of technical education, they are in a pivotal position to take forward the development of technical education which is increasingly recognised as making an important contribution to the UK's productivity and economic growth.

In order to further develop colleges' capacity and capability, we recommend that the AoC considers:

- undertaking an audit of their members to ascertain present capacity and capability to deliver further technical education at levels 3,4 and 5
- sharing examples of good practice in providing technical education, including drawing on expertise from the forthcoming institutes of technology
- leading discussions about how best to ensure that staff can maintain and update their knowledge, skills and expertise in their employment/ business sectors.

We also recommend that there is a need to develop a more detailed understanding of technical education teaching and learning building on the work of the Commission on Adult Vocational teaching and Learning (2013) and reflecting current commentary on professional and technical education.

We believe that these actions would help the FE sector to meet the growing technical education challenge.

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Appendix A Review parameters, search strategy and strength of the evidence reviewed

Search strategy

Bibliographic databases

We searched a range of bibliographic databases (the Australian Education Index, the British Education Index, the Education Resources Information Center (ERIC) and the Idox Information Service) using 'technical/vocational education' terms combined with 'learning/teaching' terms tailored to the specific search capability of each database. We also undertook a limited number of author searches based on recommendations from the Association of Colleges.

In addition we 'hand searched' the tables of contents in volumes of the following journals published between January 2010 and June 2015:

- *Career and Technical Education Research*
- *Journal of Further and Higher Education*
- *Journal of Vocational Education and Training*

The search strategy for each database reflects the differences in database structure and vocabulary. Throughout, the abbreviation 'ft' denotes that a free-text search term was used and the symbol * denotes truncation.

Australian Education Index (searched via Proquest 25/06/15) – 403 hits

#1 Adult vocational education

#2 Apprenticeships

#3 Career and technical education (ft)

#4 Competency based training

#5 Competency based education

#6 Job training

#7 On the job training

#8 Off the job training

#9 Higher vocational (ft)

#10 Professional and technical education (ft)

#11 Skills

#12 TAFE

#13 Technical education (ft)

#14 Vocational education

#15 Vocational education and training

#16 Vocational training (ft)

#17 Industrial education

#18 Vocational high schools

#19 Work preparation centres

#20 Work based learning

#21 Work based training (ft)

#22 Workplace learning

#23 #1 or #2 or #3…#22

#24 Active learning

#25 Communities of practice (ft)

#26 Inquiry

#27 Learning

#28 Learning processes

#29 Problem based learning

#30 Recontextuali* (ft)

#31 Teaching (ft)

#32 Teaching effectiveness

#33 Teaching methods

#34 Teaching process

#35 Student projects

#36 #24 or #25 or #26… #35

#37 #23 and #36

#38 Technical education (ft)

#39 #37 or #38

Author searches

#1 Avis, James

#2 Eraut, Michael

#3 Fuller, Alison

#4 Guile, David

#5 Hordern, Jim

#6 Lave, Jean

#7 Lea, John

#8 Tynjala, Paivi

#9 Unwin, Lorna

#10 Wenger, Etienne

British Education Index (searched via EBSCO Host 30/06/15) – 382 hits

#1 Apprenticeship programs

#2 Career and technical education (ft)

#3 Cooperative education

#4 Higher vocational (ft)

#5 Job skills

#6 Manual training

#7 Occupational training

#8 Outcome-based education

#9 Professional and technical education (ft)

#10 School to-work transition

#11 Technical education (ft)

#12 Technical institutes

#13 Vocational education

#14 Vocational high schools

#15 Vocational schools

#16 Vocational training centers

#17 Workplace learning (ft)

#18 #1 or #2 or #3…#17

#19 Active learning

#20 Communities of practice (ft)

#21 Effective teaching

#22 Inquiry-based learning

#23 Learning

#24 Pedagog* (ft)

#25 Problem-based learning

#26 Project method in teaching

#27 Recontextuali* (ft)

#28 Student projects

#29 Teaching

#30 Teaching methods

#31 #19 or #20 or #21…#30

#32 #18 and #31

#33 #32 or #11

Author searches

#1 Avis, James

#2 Eraut, Michael

#3 Fuller, Alison

#4 Guile, David

#5 Hordern, Jim

#6 Lave, Jean

#7 Lea, John

#8 Tynjala, Paivi

#9 Unwin, Lorna

#10 Wenger, Etienne

ERIC (searched via EBSCO Host 22/06/15) – 1287 hits

#1 Adult vocational education

#2 Apprenticeships

#3 Career and technical education (ft)

#4 Competency based education

#5 Job training

#6 Higher vocational (ft)

#7 Off the job training

#8 On the job training

#9 Professional and technical education (ft)

#10 Skills

#11 Technical education

#12 Trade and industrial education

#13 Vocational education

#14 Vocational schools

#15 Vocational training

#16 Vocational Training Centers

#17 Work-based learning (ft)

#18 Work-based training (ft)

#19 Workplace learning

#20 #1 or #2 or #3 or.... #19

#21 Active learning

#22 Communities of practice

#23 Inquiry

#24 Instruction

#25 Learning

#26 Learning processes

#27 Pedagog* (ft)

#28 Problem-based learning

#29 Recontextuali* (ft

#30 Student projects

#31 Teaching (ft)

#32 #20 or #21 or #22 …. #31

#33 #32 and #20

#34 technical education

#35 #33 or #34

Author searches

#1 Avis, James

#2 Eraut, Michael

#3 Fuller, Alison

#4 Guile, David

#5 Hordern, Jim

#6 Lave, Jean

#7 Lea, John

#8 Tynjala, Paivi

#9 Unwin, Lorna

#10 Wenger, Etienne

IDOX (searched 29/06/15) – 511 hits

#1 Vocational education

#2 Vocational training

#3 Technical education

4 #1 or #2 or #3

#5 Teaching

#6 Learning

#7 Pedagog*

#8 #5 or #6 or #7

#9 #4 and #8

(all ft)

Author searches

#1 Avis, James

#2 Eraut, Michael

#3 Fuller, Alison

#4 Guile, David

#5 Hordern, Jim

#6 Lave, Jean

#7 Lea, John

#8 Tynjala, Paivi

#9 Unwin, Lorna

#10 Wenger, Etienne

VOCEDplus (searched 25/06/15) (number of hits unavailable)

Note: VOCEDplus is a database of international tertiary vocational education research. The search strategy used for VOCEDplus reflects the extensive specialist nature of this database in the field of international tertiary vocational education research.

#1 technical education

#2 effective teaching

#3 good teaching

#4 effective learning

#5 effective pedagogy

#6 professional and technical education

(all ft)

Author searches

#1 Avis, James

#2 Eraut, Michael

#3 Fuller, Alison

#4 Guile, David

#5 Hordern, Jim

#6 Lave, Jean

#7 Lea, John

#8 Tynjala, Paivi

#9 Unwin, Lorna

#10 Wenger, Etienne

Website searches

We also browsed the publications / research / policy sections of the following websites:

- The Association of Colleges (AoC), Association of Employment and Learning Providers, CBI, Centre for Learning and Life Chances in Knowledge Economies and Societies (Institute of Education), Centre for Real World Learning (University of Winchester), City and Guilds Centre for Skills Development, Commission on Adult Vocational Teaching and Learning, Department for Business, Innovation and Skills (BIS), Department for Education (DfE), Department for Employment and Learning (DEL) (Northern Ireland), Edge Foundation, Education and Employers Taskforce, Excellence Gateway, Gatsby, Learning and Skills Improvement Service (archive), National Center for Innovation in Career and Technical Education (US), National Centre for Vocational Education Research (NCVER – AUS), NIACE, OECD, Scottish Government, UK Commission for Employment and Skills (UKCES), University of Huddersfield (research affiliated to the Centre for Research in Post-compulsory Education) and Welsh Government.

Breakdown of items reviewed by country

The geographical focus of this research was the United Kingdom, Australia, Canada and the United States. The table below provides a breakdown of geographical distribution of the 17 shortlisted items by country

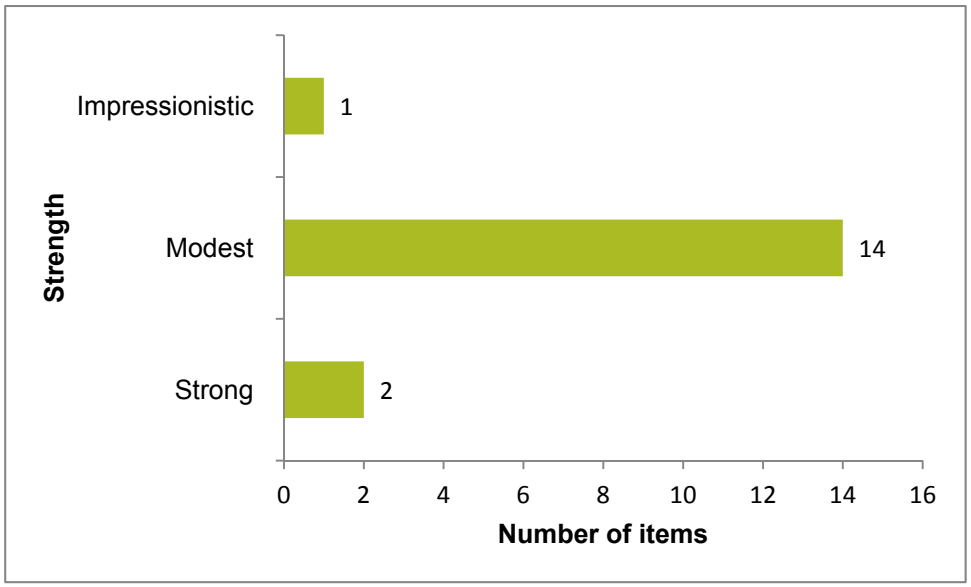
Table 1: Items reviewed by country

Country	Total items[1]
United Kingdom	10
Australia	6
United States	2
Canada	2

Strength of evidence reviewed

As Figure 1 below shows, most studies provided 'modest' evidence often based on literature reviews, but also included a fairly large quantitative survey and mixed methods approaches (including a literature review combined with case studies involving face-to-face interviews). Two studies were noted as 'strong' and one study was categorised as 'impressionistic' as it was based on an opinion piece.

Figure 1: Strength of evidence



Each item was also rated on its relevance to answering the research questions, ranging from highly relevant to limited relevance. Two items were deemed highly relevant, seven were mostly relevant and a further eight had limited relevance.

[1] Some items span more than one country.

Appendix B Review template

Full reference	
Research summary/overview	
Research aims: Key findings:	
About the source	
Type of literature (e.g. research report, journal article, literature review, opinion piece)	
Study population/sample size	
Country/area covered e.g. UK, England only	
Research design/method e.g. analysis of dataset, longitudinal survey, consultation, interviews	
Year research was carried out (if applicable)	
Information from source relevant for background/context	
Relevance to research question 1: ***What are the characteristics of technical and vocational education?***	

Relevance to research question 2: ***What makes good technical teaching and learning?***

Relevance to research question 3: ***How does teaching and learning in technical and vocational subjects differ from the teaching and learning of academic and general subjects?***

Any gaps in research identified?

Overall comment on of relevance to *research questions*

Highly relevant ☐

Mostly relevant ☐

Limited relevance ☐

Overall strength of evidence

E.g. ***strong*** evidence as large-scale quantitative study that analyses large datasets; ***modest*** evidence as based on a fairly large quantitative survey/mixed method, large qualitative study; ***impressionistic*** as based on based on observation or opinion, or on one case-study, or the views of one person, for example.

NFER provides evidence for excellence through its independence and insights, the breadth of its work, its connections, and a focus on outcomes.

NFER ref. AOCT

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- independent
- insights
- breadth
- connections
- outcomes

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