



Evaluation of university technical colleges

Final report

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NFER:

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Students can study a technical specialism alongside core academic subjects at GCSE and A-level.

Executive Summary

INTRODUCTION

The Royal Academy of Engineering (the Academy) and the Edge Foundation commissioned the National Foundation for Educational Research (NFER) to evaluate the project-based learning and employer-informed curriculum development and delivery aspects of University Technical Colleges (UTCs) between January 2017 and December 2018. We published an interim report focusing on phase 1 of the research in 2017. This is the final report.

UTCs are schools for 14 to 19 year olds that deliver an education which combines technical, practical and academic learning. Students can study a technical specialism alongside core academic subjects at GCSE and A-level. Two important elements of the UTC model are the involvement of employers in the curriculum and the use of project-based learning. There are 49 UTCs open in England at the time of this report.

RESEARCH AIM AND OBJECTIVES

The overall aim of the study was to understand effective practice and lessons that can be learned from the approaches currently being adopted, particularly in relation to curriculum design and employer engagement, as well as the broader challenges facing UTCs. More specifically, the objectives of the research were to:

- ascertain the use of project-based learning (PBL) and employer engagement in the development and delivery of the curriculum within UTCs at Key Stage 4 and post-16
- share the most effective practice and identify lessons learned, including areas that have been less successful, in order to inform future sector-wide practice.

RESEARCH METHODOLOGY

We have used a case-study methodology supplemented with management information on the schools and a survey of UTC students' views on education in general and UTCs specifically.

Further to phase 1 (carried out in 2017) of this study where we carried out ten UTC case studies, in phase 2 (carried out in 2018) we re-visited three UTCs identified as demonstrating profound¹ employer engagement in PBL. In phase 2, we interviewed three senior leaders, five heads of department, two teachers and three employers. We also completed three focus groups with Year 13 students and two focus groups with Year 11 students.

In phase 2, we also received 200 completed student questionnaires from six UTCs (we received 466 completed questionnaires in phase 1). Overall, responses from young people completing the survey should be interpreted with caution due to the changing makeup of the sample from one year to the next (e.g. some UTCs responding in phase 1 did not respond in phase 2). Response rates varied from 132 completed questionnaires from one UTC in phase 1 to nine completed questionnaires from one UTC in phase 2.

In the autumn of 2018, we also investigated the destinations of the young people involved in phase 2 of the research; either through telephone interviews with the young people or through contacting the UTC staff.

We have included in this report a promising practice guide for practitioners.

1. Contextual: where partners provide information about the workplace and activities that help to inform young people about technical and transferable knowledge and skills. 'Moderate': where partners are involved in PBL but are not playing a significant role. 'Profound': where partners typically take ownership of a project; input into formative assessment; influence the delivery of curriculum components; and inform teaching and learning with specialist, current, technical skills and knowledge.

KEY FINDINGS

Project-based learning and employer engagement

Project-based learning, a key focus of UTCs and of the evaluation, was described by staff at the three UTCs and by employers as demonstrating a different way of learning for young people. PBL projects are industry-relevant and most effectively developed in collaboration with local employers to ensure that the qualifications and other outcomes achieved help students to secure positive future pathways in the local area and beyond. Senior leaders and other staff at the UTCs reported that they were continually identifying potential partners and were developing strong working relationships based on mutually-beneficial activities. Their focus was generally on developing long-term employer relationships and PBL activities, rather than investing time in one-off ventures.

These findings corroborate phase 1 conclusions that these high-performing UTCs use a range of approaches to engage and liaise with employers and to utilise their input into the design and delivery of the curriculum.

Perceived impact on young people

The evidence indicates that PBL and employer input, where delivered in a high-quality embedded way, deliver wide-ranging impacts for students, including work-readiness, enhanced emotional skills, high-level technical skills, and qualifications/awards. Additionally, access to industry professionals and working on a variety of projects with different employers over Key Stages 4 and 5 contribute to informed decision-making over their destinations and their futures. UTC staff interviewees noted young people's enhanced levels of confidence, motivation and engagement in their education.

Young people felt that their classroom-based and project-based learning supported each other. They were aware that the work-ready skills they were acquiring were transferable and could also be used to support job, apprenticeship and university applications.

As reported in phase 1, students believed that attending the UTC had improved their confidence, motivation and engagement in learning.



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Challenges faced by UTCs

As reported in phase 1, the main challenges phase 2 UTCs faced were:

- ensuring that they secured and managed a suitable range of employers providing high-quality input into the curriculum;
- recruiting and retaining appropriate students with an interest in the specialism and who were motivated to engage and succeed;
- and recruiting and retaining high-calibre staff with appropriate knowledge, experience and skills.

Additionally, UTC staff highlighted the challenge of engaging SMEs which had limited capacity and resources to support UTCs. They also pointed out that staff mobility within companies means that contacts and relationships require constant reinvestment of time by key UTC staff.

Advice for UTCs and other institutions


The three case-study UTCs offered the following advice to UTCs and other institutions wanting to embrace employer-informed PBL:

1. **Be proactive and target the ‘right’ employers.** Research and understand the local economic and industrial sector to identify the companies that will fit best with the school’s PBL approach. Schools should continually reach out to businesses, asking how the school can support and help them become involved in curriculum design and delivery, thereby helping to meet employers’ recruitment needs in the future. Record all connections with employers systematically and ensure the senior leadership team has access to activity records.
2. **Develop and train staff so that they share a common goal and fully embrace the importance of employer input into PBL.** Identify the staff member who will own the relationship and the project.
3. **Promote UTCs (or the school) and their educational approach.** Demonstrate how employers can play an

integral part in developing and delivering PBL and, at the same time, reap rewards for their business.

4. **In order to improve the constantly evolving PBL model, consider including timetable changes.** In this way students, for example, can access a full day of uninterrupted PBL rather than sessions being spread across the week.
5. **Employ key staff with industry backgrounds and connections.** This will enhance the relationships between the school and local businesses – this is a key way of developing the depth and breadth of PBL.
6. **Make employer contributions clear and easy to understand.** Explain in as much detail as possible exactly what they will need to do. Allow employers to contribute at a level that suits them. Involve employers early on in any project and support them so that they know exactly what their contribution will be and when and reassure them that the school will do as much as possible to facilitate their contribution.
7. **Celebrate successful completion of projects.** Secure students’ buy-in and full understanding that PBL and working with employers, will enable them to gain skills and knowledge so they will ‘stand out’ in future.

Overall, evidence from the three phase 2 UTCs endorses the phase 1 findings (McCrone *et al.*, 2017) that they have developed ways to invigorate learning so students see its relevance to their future lives. Students recognised that the projects and employer engagement benefitted their academic learning and developed their technical and ‘work ready’ skills. They were aware that they were acquiring appropriate workplace behaviour, communication and interpersonal skills, developing their problem-solving skills as well as learning industry-relevant skills and knowledge. Additionally, UTC staff interviewees pointed out that young people’s confidence had improved through working with employers, their understanding of the way the world of work operates had progressed, and their decision-making was better informed.

A female student with brown hair, wearing safety goggles and a white lab coat over a blue plaid shirt, is holding a metal rod vertically. She is using a blue vernier caliper to measure the diameter of the rod. Her hands are visible, and she is looking directly at the camera. The background is a plain, light-colored wall. There are several semi-transparent white circles overlaid on the left side of the image.

60% of the employers who were surveyed valued problem-solving alongside resilience and communication as one of the three most significant considerations when recruiting school/college leavers.

1. Introduction

The Royal Academy of Engineering (RAEng) and the Edge Foundation commissioned the National Foundation for Education Research (NFER) to evaluate the project-based learning and employer-informed curriculum development and delivery aspects of University Technical Colleges between January 2017 and December 2018. This report presents the findings from phase 2 (carried out in 2018) of the research. The phase 1 (carried out in 2017) report was published in November 2017 (McCrone et al., 2017).

BACKGROUND

University Technical Colleges (UTCs) are schools for 14–19 year olds that deliver an education that combines technical, practical and academic learning. Students can study a technical specialism alongside core academic subjects at GCSE and A Level. There are currently 49 UTCs open in England.

Two important elements of the UTC model are the involvement of employers in the curriculum and the use of project-based learning. This evaluation focuses on these two elements with the aim being to ascertain the use of project-based learning (PBL) and employer engagement in the development and delivery of the curriculum within UTCs. In this background section of the report we outline the characteristics of PBL and draw on the findings of phase 1 of the study to identify the role of employer engagement in providing real-world experiences in PBL.

The Buck Institute for Education (2017) defines project-based learning (PBL) as:

A teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, or challenge. (p.1).

Menzies et al., (2016) explain that PBL is a type of inquiry-driven learning based on three constructivist principles: learning is context-specific; students are involved actively in the learning process; and students learn through social interactions and the sharing of knowledge and understanding. They note that the context of learning is provided through authentic

questions and problems within real-world practices that lead to meaningful learning experiences. Patton (2012) emphasises the importance of deciding the ‘essential question’ for a project which ‘both inspires and requires students to conduct serious research’ (p.38).

In their Gold Standard PBL: Essential Project Design Elements, the Buck Institute for Education (2015a) recommends that all projects include a focus on developing ‘success skills’ which are critical thinking and problem solving, collaboration, and self-management. Helle et al., (2006) point out that ‘the most distinctive feature of project-based learning is problem orientation, that is, the idea that a problem or question serves to drive learning activities’ (p.290). Lam et al., (2010) situate problem solving in student-centred learning approaches which aim to equip students with skills in critical thinking, collaboration and communication. They elucidate how:

They [students] pursue solutions to a problem by asking and refining questions, debating ideas, making predictions, collecting and analysing data, drawing conclusions and communicating their findings to others. (p.2)

In their education and skills annual report, *Educating for the Modern World* (2018), CBI/Pearson note that 60 per cent of the employers who were surveyed valued problem-solving alongside resilience and communication as one of the three most significant considerations when recruiting school/college leavers (p.23).

Bell (2010) explains that PBL is a student-driven, teacher-facilitated approach through which students construct knowledge. She reports that working on projects which involve solving real-world problems deepens students' learning. Hmelo-Silver et al., (2007) highlight the importance of 'scaffolding' in PBL which involves supporting students to progress and achieve deeper understanding and greater independence in the learning process:

Scaffolded inquiry and problem-based environments present learners with opportunities to engage in complex tasks that would otherwise be beyond their current abilities ... students become increasingly accomplished problem-solvers given structure and guidance... (p.100)

The role of student agency in the PBL learning process is identified within 'reflection', one of the six criteria in the Buck Institute for Education's A Framework for High Quality Project Based Learning (2015b)¹. Reflection involves students learning to evaluate the quality of their work and thinking about how to make it better. The Framework elaborates the enhanced role of student agency in the learning process:

By reflecting on what they have accomplished, students retain project content and skills longer, develop a greater sense of control over their own education, and build confidence in themselves. (p.4)

Students gaining confidence through this learning approach is illuminated by Patton (2012) who concludes that:

When students do projects, they surprise themselves, their parents, and their teachers with what they are capable of. When they present their work to a wide audience, they become confident and articulate advocates for themselves, who will go on to stand out at university and in the world of work (p.78)

In phase 1 of the evaluation, we discovered that PBL is linked closely with profound employer involvement. Specialist theoretical, practical and applied learning

is informed by an employer providing an 'authentic, engaging and complex question, problem, or challenge' (McCrone *et al.*, 2017). The research findings suggested that PBL is characterised by a strong focus on making students work-ready and gaining the skills that employers need. Students acquire the skills, knowledge and qualifications directly informed by active employer engagement in real-world projects and activities.

This report presents findings, illustrations and insights from our in-depth research into UTCs' design and delivery of PBL, including the contribution of employers to this learning approach.

As noted above, providing real-world learning opportunities is key to meaningful PBL delivery. In phase 1 of this study we found examples of a variety of ways that employers were engaging with UTCs including PBL. This included:

- supporting teachers to relate lessons to the world of work through real-life *application* of theoretical learning into practical work
- informing the curriculum with *current* industry skills needs
- enabling observation and experience of *everyday* industry activity
- setting *genuine, authentic* challenges or problems for young people to solve
- providing *ongoing, regular* input such as weekly input throughout the life of a project or at the briefing/set up and final stages of a project
- employers arranging visits to their workplaces; giving talks; providing access to resources and facilities, such as engineering workshops and media recording studios; and drawing on their sector specialist expertise.

We identified different levels of employer involvement with UTCs which included 'profound' and 'moderate' involvement. Profound involvement entailed employers contributing to the curriculum planning and development process for a considerable length of time, often from UTC inception. Where there was most profound employer

1. The other quality criteria are: intellectual challenge and accomplishment; authenticity; public product; collaboration; and project management.

engagement, employer-led projects were recognised to constitute a part of the curriculum on an ongoing basis. In these cases, UTC staff and employers co-developed projects using UTC staff's educational and pedagogical expertise and their knowledge of qualifications' assessment criteria alongside employers' knowledge of current technical skills and industry requirements. Profound involvement was characterised by employers:

- taking 'ownership' of a project, for example by using their company branding to identify the qualification module or unit
- inputting into formative assessment and feedback to students
- influencing the delivery of curriculum modules/units, for example employers suggest their ideas for live briefs and UTC staff make sure they meet the qualification requirements
- informing teaching and learning with specialist, current, technical skills and knowledge.

Where there was moderate employer involvement, projects typically formed an important – but not central – part of the qualification achievement. Employers did not have 'ownership' of the project and responsibility for driving projects forward to completion was usually more distributed between employers and UTC staff. We found that the UTC would usually lead project development and employer input was normally a substantial part of the learning and the achievement of qualification units or modules.

AIMS AND OBJECTIVES

The overall aim of this study was to understand and identify promising practice and lessons that can be learned from the approaches currently being adopted by UTCs in relation to curriculum design and employer engagement. More specifically, the objectives of the research were to:

- ascertain the use of PBL and employer engagement in the development and delivery of the curriculum
- share the most effective practice and identify lessons learned in order to inform future sector-wide practice.

METHODOLOGY

In phase 2 we have used a case-study methodology, a survey of young people's views of education in general and UTCs specifically and we asked follow-up questions on the destinations of the Year 11 and 13 students who took part in the focus groups as part of the case studies.

Case studies

We visited ten UTCs in phase 1 (carried out in 2017) and data analysis indicated those that demonstrated profound employer engagement. In phase 2 (carried out in 2018), we selected three UTCs that provided examples of different approaches to profound employer engagement and PBL and carried out additional case-study visits. In total across the three phase 2 case studies, we interviewed three senior leaders, five heads of department, two teachers and three employers. We also conducted three focus groups with Year 13 students and two focus groups with Year 11 students. In addition, we questioned the focus-group student interviewees approximately three months after they completed Year 11 or Year 13 about their selected destinations.

Student surveys

In phase 2, we received 200 completed questionnaires from Year 11 and 13 students in six UTCs (in phase 1 we received 466 responses from eight UTCs).

Overall, responses from young people completing the survey should be interpreted with caution due to the changing makeup of the sample from one year to the next (e.g. some UTCs responding in phase 1 did not respond in phase 2). Response rates varied from 132 completed questionnaires from one UTC in phase 1 to nine completed questionnaires from one UTC in phase 2.

SPSS was used to clean and analyse data collected from student surveys. Five-point response scales (*strongly agree, agree, not sure, disagree, strongly disagree*) were collapsed to form three-point scales combining *strongly agree* and *agree* responses into one category (*agree*), and *strongly disagree* and *disagree* responses into another category (*disagree*). Frequency tables were generated based on these collapsed categories.

Management information

The following data was used to produce background data tables for phase 1 (these tables are also available in the technical appendix of this phase 2 report):

- pupil characteristics data from DfE Schools, Pupils and Characteristics: January 2017
- attainment data: DfE performance tables from 2016/17 academic year
- Key Stage 2 Average Point Scores: calculated from pupil level data for individuals in the relevant cohort using the National Pupil Database.

A sample of schools opening at the beginning of the 2017/18 summer term was created using data from the DfE's 'Get Information about Schools' website and matched to the DfE Schools, Pupils and Characteristics dataset.

Data tables include the following school types: *Academy Converter, Sponsored Academy, Community School, Foundation School, Free School, Studio School, University Technical College, City Technical College, Voluntary Aided School, and Voluntary Controlled School*. Schools in the sample all have a statutory age range enabling them to have a KS4 cohort.

Attainment figures were not included in the calculation of averages if schools had entered five or fewer students for exams. Values are suppressed in data tables where pupil numbers are fewer than five for a particular cell.

OVERVIEW OF PHASE 1 RESEARCH FINDINGS

The findings from phase 1 of this research indicated that there is a range of approaches currently being used by the ten case-study UTCs to engage and liaise with employers and to utilise their input into the design and delivery of the curriculum. At its most profound level, some UTCs have developed relationships with employers where they are co-developing and delivering PBL, with employers taking ownership of units or modules of the curriculum. The research findings indicated considerable employer awareness and presence at all the UTCs we visited.

In addition to the perceived positive impact on young people (such as improved academic learning, enhanced technical skills and knowledge and increased transferable skills) UTC staff and their key partners felt that young people are typically better prepared for the world of work.

The main challenges the case-study UTCs faced were ensuring that they secured and managed a suitable range of employers providing high quality input into the curriculum; recruiting and retaining appropriate students with an interest in the specialism and who are motivated to engage and succeed; and recruiting and retaining high-calibre staff with appropriate knowledge and skills.

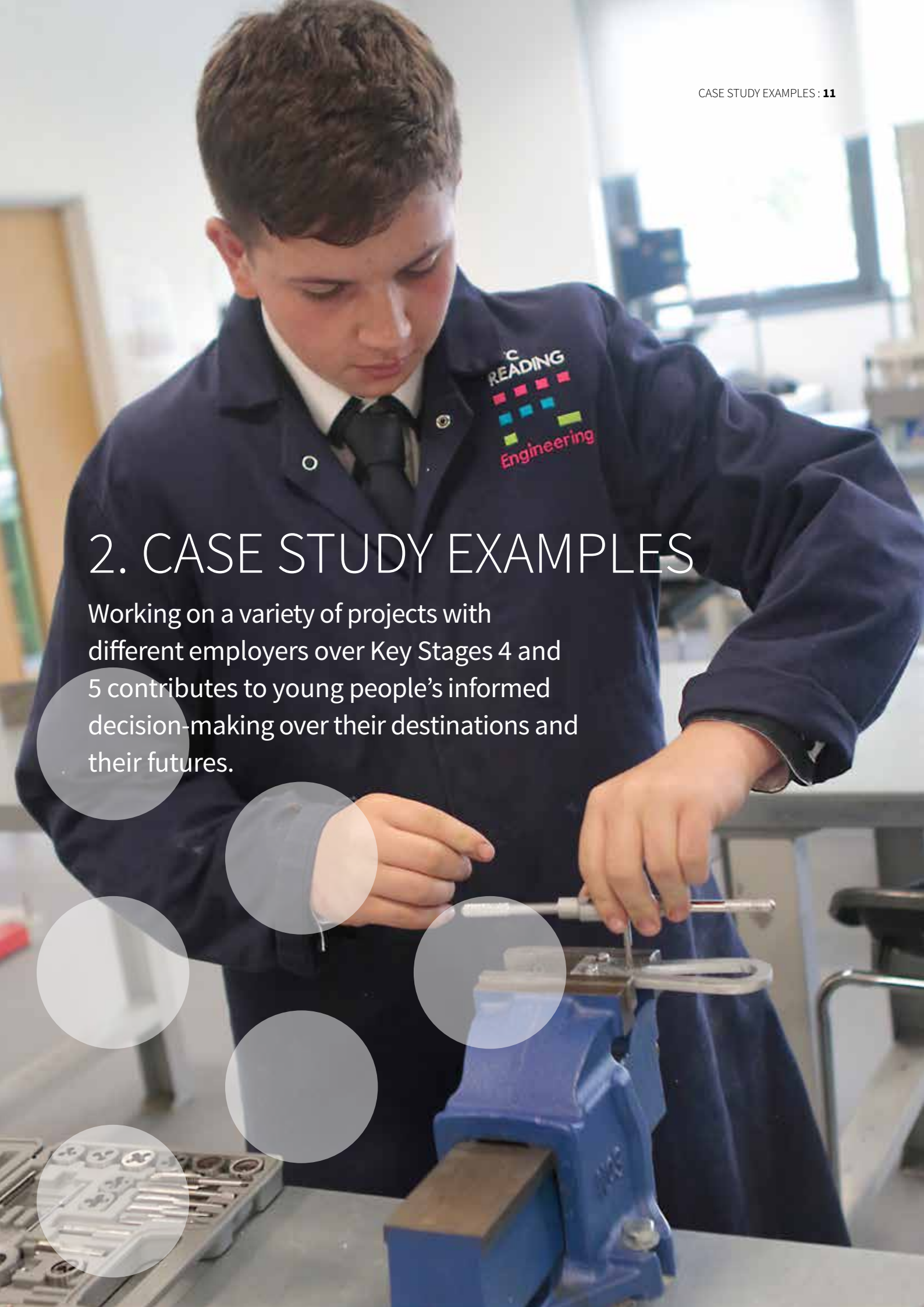
The findings from phase 2 of this study on employer engagement and PBL, including perceived benefits and challenges addressed, are presented in the report, alongside recommendations for the future development of PBL and employer engagement.

STRUCTURE OF REPORT

After the executive summary and introductory chapter, Chapter 2 presents case studies of three UTCs which describe their approaches to delivering PBL, the benefits and emerging impact of using PBL, the challenges they have encountered and how these have been addressed, and their advice to other schools. Chapter 3 provides data on UTC leavers' destinations and feedback on leavers from the three case-study UTCs. Chapter 4 presents promising practice guidance on employer engagement and PBL based on the evidence collected and analysed for this evaluation. Chapter 5 presents conclusions and recommendations to UTCs for the further development of PBL and employer engagement.

2. CASE STUDY EXAMPLES

Working on a variety of projects with different employers over Key Stages 4 and 5 contributes to young people's informed decision-making over their destinations and their futures.



2. Case-Study Examples

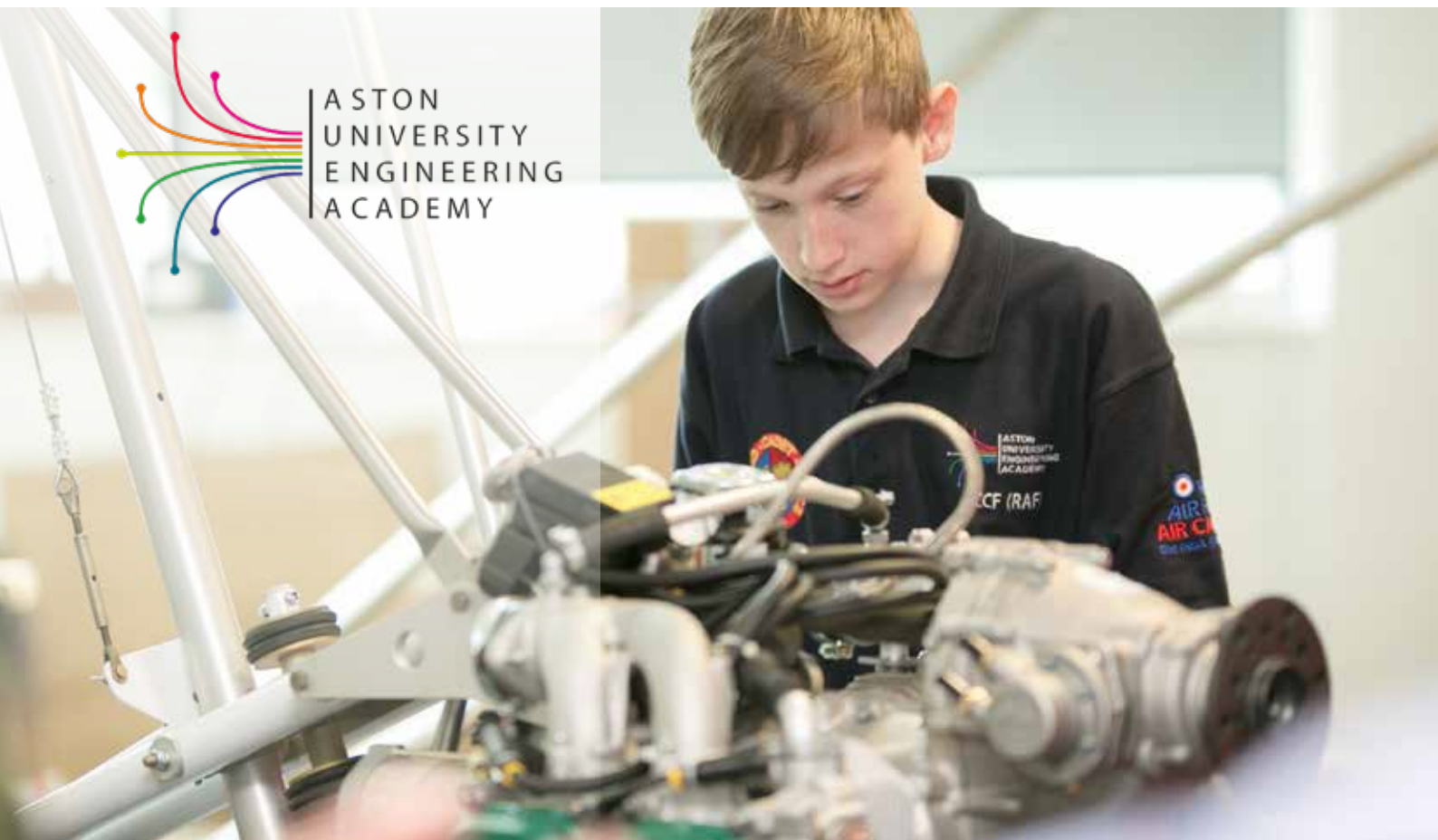
Three UTCs demonstrating profound employer engagement in phase 1 of this project were invited to take part in case studies as part of phase 2 of this research.

ASTON UNIVERSITY ENGINEERING ACADEMY (AUEA)

Background

Aston University Engineering Academy (AUEA) opened in 2012 and specialises in different aspects of engineering. In 2017, 48 per cent of Year 11 students achieved at least 5 A* to C or 9-4 grade GCSEs, including English and maths. PBL activities are delivered as part of the Student Professional Development element of the AUEA curriculum offer. During weekly dedicated Student Professional Development time, students can participate in projects, enrichment activities or extended work placements. The rationale underpinning this approach is to offer industry-based activities

and opportunities to support students' learning and development and to 'help them stand out' in their future pathways, through providing experiences and skills to enhance their CVs, interview performances, and university and job applications. PBL generally takes place one afternoon a week for Year 10-13 students between September and February. Project groups/teams comprise students from across the year groups who have shown an interest in the topic, although experience of Student Professional Development (including PBL) varies across the year groups, with less time available for project work at key academic times such as pre-GCSE and A level examinations.



Approaches to PBL and employer engagement

Senior managers at AUEA have developed a structured approach to project design and delivery based on extensive communication with local partners and employers. The Vice Principal, Director of Engineering and Principal are primarily responsible for developing and maintaining relationships with engaged employers. This gives employers consistent, known points of contact within the UTC to enable efficient communication. Within this approach, curriculum staff are not precluded from contacting and introducing new employers and developing links, such as inviting relevant local business personnel into lessons, but these relationships are then managed by senior staff. A central database is maintained so that students and staff can keep track of their engagements with employers - through for example, projects, work experience and placements - and to help students build portfolios of evidence to support their future pathways.

The AUEA senior management team, key employers and curriculum leaders have collaborated to devise a dynamic range of projects that support the key industrial sectors relevant to AUEA's curriculum offer. Projects are generally staffed by AUEA personnel who have been invited by curriculum leaders to be involved, with varying levels of employer engagement occurring throughout. Students can choose to undertake a project in their preferred sector(s) which is tailored to their desired future employment destination. Sectors include: engineering, automotive, electronics, communication, aerospace, product design, science and sport. Projects are generally sponsored or backed by companies, organisations and qualification-awarding bodies, and fall into three categories:

- **Live projects** are directly linked to a 'customer' outcome. For example, an A level design group has been tasked with designing new camera mounts that will be used in AUEA classes. Personnel from a design company have visited the UTC to introduce the project and brief students who will then go on to design the product. There has been on-going dialogue with the design company which has included an on-line platform where students can post questions during the design process. The company will then sign off the design if it meets their criteria.
- **Qualification/awards** are projects that do not have a final customer outcome, but students do get industry valued accreditation. For example, up to 100 students will be entered for the Fusion 360 Auto CAD software accreditation. Through tutorials students work to design and manufacture a product using the CAD software 3D printing. For some Year 11 students, this is integrated with other on-going smart product design projects. Students' work is assessed, then they are awarded a professional, accreditation qualification in this software that '*will make them stand out from the crowd in the future*' (staff member).
- **Enrichment** involves participation in STEM-based activities that do not result in a final customer outcome. Examples include the Combined Cadet Force (CCF) and Duke of York awards, which are seen as very positive additions to students' CVs as they involve a blend of technical skills, work-based knowledge and experiences, and a range of transferable skills, such as problem solving, which are highly valued by employers.

Benefits of PBL and employer engagement approach

The location of PBL within the wider Student Professional Development structure (see section 2.1.1 above) facilitates employer involvement at varying levels, allowing companies to contribute and engage to an extent which is appropriate to their circumstances. This approach has led to the development of closer relationships and greater understanding between the UTC and local employers due to enhanced working relationships.

PBL contributes to AUEA's overall educational offer because it is integrated into the whole curriculum and is '*not a bolt on, added on at the end of the day like a STEM Club*'. However, one of the key benefits of this approach is that PBL projects are distinct from the rest of the curriculum in their nature, content and methods of delivery. Within the overall context of planned learning, projects are characterised by significant elements of student direction, where students are able to input their ideas that influence the project path, and initiation to support imaginative and creative working. As a senior staff member commented, '*I want staff to facilitate it, not teach it. It needs to be different*'. By choosing the sector,

not a particular project, students acquire increased opportunities to develop deeper understandings of the overarching nature of the subject area in which they are interested rather than being attracted to the particular project itself. Projects generally have defined end-points, so their time-limited nature gives students experience of working to deadlines reflecting the real world of industry where briefs have to be devised and products designed and delivered within an agreed timescale.

Challenges and how they have been overcome

The UTC has encountered a number of challenges associated with delivering PBL which are mainly relating to local socio-economic and industrial contexts. The fundamental challenge stems from the fact that the most relevant businesses in the area are SMEs with limited capacity and resources to successfully engage with, and support, the UTC. Increasing demands for employer engagement, work placements and work experience from other UTCs and educational establishments intensifies this challenge. Efforts to overcome these barriers centre on dialogue and communication and the promotion of the AUEA in the local business community, highlighting how involvement with AUEA will benefit businesses. In addition, staff mobility within companies means that contacts and relationships require constant reinvestment of time by key UTC staff *'to stop it dissipating into nothing'* (senior staff member). Other challenges include the low aspirations and lack of motivation of some of the younger students and getting them to buy into, and understand, the concept and ethos of PBL and how it differs from the rest of the curriculum, for example involving more active learning. As one staff member commented: *'We really didn't want projects to be another lesson ... Students can initially struggle with this, as they are waiting to be taught'*. Providing a diverse range of projects facilitated by committed staff who understand the rationale and ethos of PBL helps students to engage with projects.

Suggested improvements and advice to other schools

The main areas for development of PBL at AUEA are at a structural, not individual project level, focussing on employer/UTC relationships. A key element of this involves targeting the 'right' employers by researching and

understanding the local economic and industrial structure to secure the involvement from companies that will fit best with the UTC's PBL approach. Following on from this, a strategy for developing multi-faceted partnerships beyond the UTC encompassing family learning providers and local employers is underway to increase aspirations of the whole community, not just AUEA students. In this way, PBL will be increasingly employer informed and seen as relevant and valuable throughout the local community. PBL can be improved through continuing to reach out to businesses, asking how the UTC can support businesses to become involved in curriculum design and delivery which will ultimately help to meet their future recruitment needs.

Emerging impact

Professional development activities, including PBL, constitute significant elements of the AUEA's overall offer and their impacts cannot be measured in isolation. However, as part of the UTC's mission to make each student a *'more rounded young person and to contribute towards creating the next generation of engineers and scientists'* (senior staff member), PBL supports the development and/or achievement of:

- students' work-readiness skills, including social and emotional development, communication and team working skills, personal development and self confidence
- tangible project outcomes and qualifications/awards, including the product or design created through 'live' projects which is often presented and celebrated in a project showcase event and assessed by employers
- positive progression opportunities for students through the acquisition of industry-relevant skills and qualifications and exposure and access to a range of potential employers. As one senior staff member commented: *'Destination data shows that the experience they are getting here, from the curriculum and the enrichment, is serving them well'*
- enhanced relationships between the UTC and its local business and wider communities as companies are becoming more aware of what AUEA can offer them in a dynamic and evolving mutually-beneficial partnership approach.

KEY FINDINGS

AUEA's approach to PBL is effective because the wide variety of projects on offer, whilst supporting the curriculum, are different in nature to other aspects of mainstream learning at the UTC. The projects are industry-relevant and developed in collaboration with local employers to ensure the qualifications and other outcomes are appropriate for helping students secure positive future pathways in the local area and beyond. Projects are facilitated by UTC staff carefully chosen and invited to be involved by curriculum leaders and senior managers to ensure that staff members' skills and experiences are aligned with the requirements of a particular project. In addition, staff are encouraged to suggest new projects within their subject/sector area and areas of personal interest. This approach is supported by the UTC's staff recruitment strategy, which aims to draw personnel from industry where possible and appropriate. Individual projects are successful because they involve hands-on, real-world experiences that reflect, and are relevant to, the world of work.

Senior staff at the UTC invest significant time to identify appropriate businesses and other partners, including local enterprise networks. In order to support local companies to become more engaged with the UTC, senior staff aim to develop strong working relationships based on communication and dialogue. This includes networking events and visits to the UTC as well as the inclusion of local business people in the UTC's governance structures. A recognition scheme to encourage and celebrate all levels of employer involvement has been introduced. The key to the success of PBL, as part of the Student Professional Development structure, is the continued emphasis on seeing the 'bigger picture' of projects. The approach is integral to the UTC's educational offer, and brings a wide variety of partners to help change the mind-set and aspirations of students, employers and the whole community. PBL, going forward, is about developing longer-term initiatives rather than focussing on isolated, shorter-term projects.

LIVERPOOL LIFE SCIENCES UTC

Background

Liverpool Life Sciences UTC opened in 2013 and has a specialised focus on life sciences and health care. In 2017, 43 per cent of Year 11 students achieved five or more GCSEs A*-C or 9-4 including English and maths. PBL at the UTC has been designed to provide students with opportunities to acquire locally-relevant technical skills, experiences and connections to support their future education, training and employment with local employers, especially in the healthcare and science sectors. A diverse range of PBL opportunities has been developed through a collaborative approach between the UTC and its business partners who have strategic input into shaping the projects and the wider curriculum offer to ensure it meets the needs of these businesses. A defining characteristic of the UTC's approach to PBL involves a degree of separation between projects and other aspects of the curriculum. This ensures that PBL prioritises employers' needs by: *'covering the science that employers are looking for rather than integrating it into qualification specifications'* (senior staff member).



Effective PBL is thus achieved through the combined input of business partners and the UTC, whereby employers often devise a live brief, challenge or project, the logistics of which are then mapped by UTC staff, including the nature and level of employer input and commitment.

Approaches to PBL and employer engagement

Owing to their strategic nature, most relationships between the UTC and its business and university partners are developed and managed centrally by members of the UTC's senior leadership team, specifically the Director of Enterprise and in terms of healthcare, a recently-appointed Health Sector Skills Champion. Other senior staff, such as the Head of Science and Innovation also work with partners on project design and delivery, where appropriate.

In close liaison with its business partners, the UTC has developed a Skills Passport which underpins the design and delivery of partner-inspired project themes, briefs and challenges. This partner-informed passport aims to cover all the skills that employers need and is reviewed and updated to make sure students are developing the skills currently demanded by employers in rapidly advancing and evolving sectors. New partners have the opportunity to discuss the passport in terms of its relevance to their business needs, how it could meet existing and predicted skills gaps and how their business could make an appropriate contribution to PBL to ensure the UTC's offer remains current. As a UTC senior staff member commented:

We deliver those skills and assess them in a way that employers will value and the students will be able to demonstrate through a portfolio of work, at interviews for a job or apprenticeship, what they have achieved.

Students are timetabled two periods each week to participate in industry-inspired projects, generally working in teams. For example, Jaguar Land Rover provide a challenge that runs for five weeks during which time students have to measure the depth of water in a glass to a very high degree of accuracy. No special equipment or resource is needed for this, but it is a fundamental question in engineering i.e. how to measure, and how to understand measurement and its importance.

Personnel from the company launch the project at the UTC. They are then available for one Skype conversation whereby students can ask them a question (if deemed to be worth their time by UTC staff) and visit the UTC again at the end of the project to judge and assess students' work. Prizes for accuracy and innovation are awarded, with the winning teams being invited to the company's site to visit the metallurgy laboratories and spend time with key company personnel. During this time, the company observes the students and identifies those with the appropriate attributes for potential future employees. These individuals may then be offered a work placement with the company which could lead to them being fast-tracked through the degree apprenticeship programme interviews. Through this project, in a short space of time with minimal financial and staff time/investment, the company provides students with a fundamentally important challenge (understanding the importance of measurement in science and engineering) and has been able to identify suitable potential future staff. As one staff member commented: *'It's profound and sustainable, they can deliver that same project year on year.'*

In the healthcare sector, Year 12 students can apply to pursue the Care Standards Certificate during their project time for one term. All students apply for, and are interviewed for, specific roles within the health team, such as doctors, nurses, team leader, ward manager and inventory manager. They then have the responsibility for maintaining the health and social care practical area in the school. The Care Standards Certificate forms the basis of the project, with the brief from healthcare provider partners being to understand the standards required and to work through the booklet, in an independent, student-led way, to complete its content. This can include using the UTC's own healthcare resources, attending sector-led master classes and undertaking placements in healthcare settings. Students' work is formally assessed at the end of the project by key staff from the UTC's hospital partner. Achieving the Care Standards Certificate means young people can carry out part-time paid work as Health Care Assistants.

Benefits of PBL and employer engagement approach

Liverpool Life Sciences UTC's approach to PBL has a broad range of benefits for students, employers and the UTC itself:

- Students acquire enhanced educational experiences, combining academic pathways, vocational technical skills and enrichment opportunities. Crucially, they can acquire high- quality, locally-relevant and current skills and experiences to support their future destinations. This approach to PBL enables the curriculum and employers to be connected, helping the curriculum to ‘make sense’ to students because of the real-world practical settings, scenarios and challenges set by business partners. According to one senior staff member: *‘students need to be given a problem by an employer, they can’t just be told it is a skill that they need to learn’*.
 - Employers define the skills they require for future workforces and their involvement in PBL can represent a potentially high-yielding investment with low levels of capital and resources required, such as staff time and commitment. As one UTC senior staff member commented: *‘Businesses wanting to relocate to the city can say to the UTC, looking at our talent pipeline, I need students that have these skills and, through PBL, we can offer those skills’*. Employers also like PBL as it is the ‘fun bit’ – they can come in and do interesting, exciting things with students.
 - The UTC reinforces its position in the local education and employment community by delivering an educational offer that is attractive to students and valued by local employers. Through PBL, staff also have opportunities for increased flexibility and creativity in their teaching compared with the constraints of the curriculum.
- can further hinder this relationship. As one business partner noted: *‘It was difficult putting the project together as I didn’t know anything about how schools worked at the time’*. Dialogue and communication is crucial to overcome this, and the appointment of industry staff to senior roles in the UTC helps bridge the gap between the two. In addition, the UTC makes strenuous efforts to ensure employer involvement as easy as possible, such as attending planning meetings at the employer site, not at the UTC.
- Varied levels of student engagement, motivation and ability have also been identified as challenges to PBL, often related to individuals’ reasons for attending the UTC. As one staff member commented: *‘Some have a drive for life sciences, some not. Some are here because it’s their last chance’*. However, offering a broad range of PBL content helps in providing opportunities to hook students in, especially through activities that are practical, hands on, and real world in nature.
 - Ensuring staff motivation and engagement can also be a potential challenge, especially when staff are unfamiliar with the concept and practice of PBL. As one staff member commented: *‘Initially, a lot of teachers just expected to come down to the labs and somebody else would deliver everything and they would be able to get on with marking. So a challenge was to address that culture by involving them in the process’*. Senior staff have overcome this challenge through providing support and continuing professional development (CPD) programmes and via a strategy of recruiting staff from industry and research environments who understand the value of practical project-orientated learning.

Challenges and how they have been overcome

A small number of challenges to designing and delivering effective PBL, and associated solutions, were identified:

- Concerns about the extent and nature of their expected role can be a barrier to employers engaging in PBL. As well as the time commitment and requirements on staff, some employers can also be deterred by the perception that they will be *‘asked to create education resources when they are not educators’*. Misunderstandings or a lack of mutual knowledge about how schools and businesses work

Suggested improvements and advice to other schools

Several suggestions were made to improve the constantly-evolving PBL model, including timetable changes so that students can access a full day of uninterrupted PBL rather than sessions being spread across the week. Utilising and sharing the resources of other schools within the wider Trust can also enrich PBL opportunities. The employment of additional key staff with industry backgrounds and connections to enhance the relationships between the UTC and local businesses is also a way of developing the depth and breadth of PBL.

Staff offered three key pieces of advice to other schools. Firstly, have a proactive approach: *'Just start. Don't wait until everything is in place or worry about any special kit or investment. Start with an initial question or challenge from an employer'* (senior staff member). The second key piece of advice is to make sure that PBL has structure and employers know what their contribution will be and that the UTC does as much as possible to facilitate employers' involvement. One senior staff member explained:

A lot of UTCs have gone to employers expecting that they will deliver something on their behalf, they will design and create and come back with a 12-week project that they will staff. That is not how you get profound employer engagement. You get that by making it possible for them to engage with you. We do that by making things simple.

Thirdly, there is a need to promote UTCs and PBL given a perceived lack of understanding amongst businesses of the uniqueness of UTCs, especially in relation to the benefits of PBL. One interviewee noted: *'Businesses would take advantage of this if they knew about it'*.

Emerging impact

PBL has delivered wide-ranging impacts for students, including the 'soft' social and emotional skills often said by employers to be lacking in many prospective employees. When combined with the high-level technical skills acquired, the industry contacts and relationships developed, and work-related opportunities experienced, students are able to stand out in their CVs, university personal statements and job



applications and interviews. The following quotations from UTC staff exemplify how PBL impacts on students:

PBL is the way to connect between the curriculum and employers as it helps the curriculum make sense. They [students] see how it will help them with their careers.

PBL gives students the opportunity to do things that they wouldn't get chance to do in the mainstream curriculum and helps them decide whether or not they want a career in health.

You can say something three times to a student and they might not listen to you. If a partner comes in, who is doing the job the student wants to do in the future, and says it, they'll listen. They see it from a real-life situation and it has a big impact.

KEY FINDINGS

Profound employer engagement in PBL at Liverpool Life Sciences UTC is facilitated by the strategic commitment from senior staff and the establishment of dialogue and communication channels to involve business partners in the design of PBL that is directly relevant to their business needs. Reviewing the Skills Passport with new and existing partners ensures the UTC's offer remains relevant and current to meet the needs of local employers. The employment of key personnel with

knowledge of industry and education to connect the school and employers is also key, as is recruiting staff with the appropriate skills to understand, deliver and 'sell' PBL to students. Employer involvement in PBL is enhanced through the logistical support provided by the UTC, allowing business partners to focus on supporting the design/content of the project rather than the organisational elements. Close liaison with business and university partners is a key element of this.

UTC READING

Background

UTC Reading opened in September 2013 and is a member of Activate Learning Education Trust (ALET), a Multi-Academy Trust (MAT) established by Activate Learning. In 2017, 76 per cent of Year 11 students achieved a grade 4 (C equivalent) or above in English and maths, with 89 per cent achieving a grade 4 or above in maths and 30 per cent achieving grade 7-9 (A-A* equivalent). The UTC provides education to students aged between 14 and 19 and offers two specialisms: computer science and engineering. Its location provides access to many businesses linked to these specialisms.


UTC Reading's prospectus describes its offer to students as including: *'opportunities to test new skills through practical, real-world projects; experiences of work which demonstrate the relevance and impact of knowledge; a focus on developing independent learning skills, communication and teamwork; and a supportive learning environment which encourages students to take risks and learn from mistakes'.*

The UTC works with industry partners in a variety of ways, for example businesses mentor students, offer enrichment activities, carry out career talks and offer work experience. Additionally, some employers work with teachers to develop project-based learning (PBL) that forms an integral part of core curriculum subjects, and reflects current industry practice.

Approaches to PBL and employer engagement

The Business Relations Manager for UTCs Reading, Swindon and Heathrow liaises with local businesses to secure their involvement at the UTCs on a level and in a way that suits the employer and the UTC. When an employer is 'on board', this staff member involves the academic staff from the relevant department and they take forward the relationship. The UTC augments funding for the role of the Business Relations Manager from sources such as industry partners for sector-specific provision and using some resource from being a teaching school to supplement the role.



 **UTC
READING**
COMPUTER SCIENCE AND ENGINEERING
EXCELLENCE FOR 14-19 YEAR OLDS

Industry partners are engaged in three stages of UTC Reading's 'talent pipeline programme': student recruitment; student development; and student destinations. One strand of the programme is CoTeach PBL where industry partners support students to develop the technical skills needed within their specialism, and to understand the relevance of these skills in the workplace.

Industry partners work with teachers to identify learning topics and design project briefs. Students work on projects in small teams for an extended period of time ranging from one term to a year. Industry partners launch the project usually at the business site; visit the UTC four times during the course of the project to deliver knowledge transfer session(s) and support and critique project work; and carry out a final visit at the end of the project to judge project presentations and select the winning team.

One example of a CoTeach project is where the Royal Electrical and Mechanical Engineers (REME), a corps of the British Army that maintains the equipment that the Army uses, works with the UTC's Engineering Department to deliver a unit of the Level 3 BTEC Diploma in Engineering. Securing the commitment of senior REME staff is important, as is the steer to REME to work with the UTC in order to develop a more cohesive approach to recruiting engineers. The UTC and REME have worked together to create an appropriate brief that will meet the BTEC assessment criteria. One senior leader at the UTC pointed out that: *'you need an employer who has the confidence'* to query educational terminology, such as assessment criteria and schemes of work. The employer described the project life cycle as having three phases:

1. The 'understanding' stage where the young people are briefed on the project at a launch day at the REME site where they can gain an understanding of the organisation and the problem that underpins the project. The fact that the project encompasses real-life problems requiring innovative solutions is critical, for example an enhancement to a small tank to enable the secure location of a radiator. The REME interviewee explained: *'The project is authentic because it is a real-life project which can make a difference in reality'*. UTC and REME staff believe that

the young people respond well to the challenge of genuine problem solving. They have a tour of the army equipment, take photos and talk to the engineers.

2. The 'support' stage where the young people return to the UTC, decide on the particular project they want to work on, are allocated to teams and start to work on solutions to the problems. They are supported by REME who supply engineers to mentor and advise young people, four times over the course of the project, as the young people develop their solutions. The young people may also return to the REME site to, for example, take additional measurements or photos.
3. The 'recognition' stage where a small panel of military staff will go to the UTC and be briefed on how the projects have progressed and how the enhancements to equipment work. The young people will present their work and take staff through an exhibition. The panel will grade the projects and the winning two teams will progress to a final stage where their projects will be appraised alongside those from other colleges. UTC staff will consider the projects according to the BTEC assessment criteria.

Following completion of the projects, UTC and REME staff will jointly hold a debrief to consider what went well and how things can be improved for the following year.

A key strategic objective of the Trust moving forward is to standardise the methodology used across ALET UTCs to enable the use of common terminology by industry partners where they seek to engage with multiple UTCs. This is currently underway and 2018-2019 will enable ALET to consolidate its engagement approach to further simplify the process for employers/partners, teachers, students and parents.

Benefits of PBL and employer engagement approach

The approach to PBL at UTC Reading has evolved in recent years. The UTC used to deliver projects through UTC-wide 'drop-down' days, but as the number of young people attending the school grew, senior leaders felt they were not achieving sufficient return on investment in terms of employer input. They have retained the

same number of ‘drop-down days’ but now use them for activities such as soft skills workshops, mentoring, careers talks and employer talks. Their new approach also links PBL to specific qualifications such as BTEC engineering units, so that one employer commits to one cohort of students on one qualification. Their plan for 2018-19 is to have one curriculum project for each specialism in each year. Since the introduction of this approach to PBL, senior leaders have recognised that curriculum choice for employers and students and support, guidance and direction for all stakeholders are key to successful implementation.

Challenges and how they have been overcome

UTC staff felt that one of the key challenges to delivering PBL with employer input is ‘recruiting and maintaining high-quality staff’ within specialisms who will work closely and effectively with industry partners. Having consistent staff working on a project was recognised by one senior leader as *‘the biggest factor in ensuring a project is successfully completed’*. Furthermore, he observed that *‘the teacher who owns the project has to be always on the ball’*. For example, it was important that employer visits were well-planned, not cancelled for unexpected reasons, and that employers were welcomed warmly. UTC staff were receiving ongoing support to value employers and their continuing input.

An additional challenge was recognised to be selection of an appropriate project that works for all partners i.e. employers, UTC staff and young people. Critical to effective PBL is the organisation of, and buy-in to, the project across partners as a lack of commitment, due to inadequate time or lack of interest, for example, can undermine successful project completion.

Suggested improvements and advice to other schools

Suggestions include:

- following up and recording all connections with employers systematically and ensuring the senior leadership team has access to activity records.
- developing UTC staff so they share a common goal and fully embrace the importance of employer input into PBL.
- ensuring employers acquire a basic understanding of the qualification including, for example, the type and content and that they recognise the importance of sending representatives who know how to relate to young people.

The Business Relations Manager summarised the critical factors to ensure effective PBL as:

- 1. ‘demystify the process for employers as much as possible. Set clear targets and explain in as much detail exactly what they need to do. And make clear the sort of person the employer needs to send to work with the young people**
- 2. identify the staff member who will own the relationship and make sure they have read and understood the brief and have bought into it**
- 3. market the project as competitive to secure student ‘buy-in’.**

Emerging impact

Interviewees universally reported that PBL and employer input resulted in young people developing their technical and employability skills. For example, students were felt to have enhanced their: presentation skills; confidence; communication skills, particularly in terms of working with other young people in teams and speaking to employers; awareness of the skills they needed in their future careers; questioning ability; awareness of how to progress a project; and understanding of the way the world of work operates (including the importance of meeting deadlines). Consultees reported that PBL gave young people a sense of responsibility as they engaged in real-life projects, prioritised their activities and worked within timelines and costings. One senior leader described how young people were ‘inspired’ by industry partners and how interaction facilitated them to *‘get what it [the world of work] is all about’*. An employer reflected that PBL made a difference to young people: *‘understanding that the responsibility and urgency of completing a project for a customer is important. And that independent work and professionalism are important.’*

Furthermore, working on a variety of projects with different employers over Key Stages 4 and 5 contributes to young people's informed decision-making over their destinations and their futures, as explained by a senior leader: *'PBL helps to shape their aspirations and decisions and develops their awareness of the routes open to them'*. Young people also recognised that these experiences provided them

with useful information for job applications (including apprenticeships), CVs, UCAS applications and interviews.

Interestingly, one senior leader reported that employers, who work with Reading UTC in different ways, were keen to understand the impact they were having on young people in terms of return for their investment.

KEY FINDINGS

- UTC Reading uses a CoTeach methodology (where teachers work with industry partners) to deliver their PBL. PBL is just one way that the UTC works with employers (other ways include the talent pipeline development programme, employability skills workshops and mentoring).
- Generally, PBL projects have three phases: the 'understanding', 'support' and 'recognition' stages.
- When all participating partners were fully engaged, PBL was widely believed to enhance young people's employability and technical skills and knowledge. Furthermore, PBL was seen to enhance young people's decision-making skills in terms of their future destinations.
- To optimise PBL, all partners (employers, teachers and young people) need to commit fully to the carefully-considered projects. This requires support from senior leaders within the UTC and the participating employer organisation.



3. YOUNG PEOPLE'S VIEWS AND DESTINATIONS

What makes UTCs stand out from colleges is the amount of actual interaction and experience we have with industry.



3. Young people's views and destinations

Young people expressed their views on education in general and UTCs specifically through focus groups and a survey. Responses from young people completing the survey³ should be interpreted with caution due to the changing makeup of the sample from one year to the next (e.g. some UTC students responding in phase 1 did not respond in phase 2) (see chapter 1 for more detail of methodology).

IMPACT OF PBL AND EMPLOYER INPUT ON YOUNG PEOPLE

Academic learning and technical skills

Across the case-study UTCs, students valued employer engagement and appreciated its importance to their learning, knowledge, and skills development.

All students were aware of the technical skills they had acquired, and valued the enhanced opportunities for 'hands-on' learning, noting their improved confidence in using technical equipment. Some students recognised that the development of these skills is often facilitated by opportunities to engage with employers and use industry-standard technical equipment:

'You learn industrial methods, rather than classroom methods.' (Year 13 student).

'What makes UTCs stand out from colleges is the amount of actual interaction and experience we have with industry. I moved to the UTC from another college last year and since being here I have interacted with employers quite a lot more.' (Year13 student).

Students recognised that classroom-based and project-based learning could support one another, with students in Year 11 noting that the transfer of technical learning to the classroom could support their GCSE preparations. Year 13 students also acknowledged the enhancement of their academic learning through the development of technical skills: ***'Without doing PBL, you'd know the word for these bits of equipment, but you'd never get to use them'*** (Year13 student).

One student also indicated that some projects had helped them to develop essay-writing skills which could be transferred to other subjects, such as English and history.

Technical skills developed by students tended to align with each UTC's specialism. Therefore, the relevance of PBL to curriculum criteria is partly dependent on subject choice. For example, students taking more science-based subjects at Liverpool UTC saw a greater connection between their academic learning and technical skills development, than those taking fewer science subjects in the same UTC.

Students enjoyed the increased freedom from curriculum guidelines that PBL gave, which allowed them to see new perspectives: ***'A levels have very strict guidelines and curriculum content, so what we could do in labs for PBL was different and gave you more freedom and independence'*** (Year13 student). They also found that employer engagement provided a welcome break from traditional academic study: ***'Sometimes it's a bit of a break from your other subjects – you find yourselves getting quite into the projects rather than just A level revision all the time'*** (Year 13 student).

Some students indicated that PBL was essential for particular qualifications. For example, one Year 13 student noted that PBL: ***'contributes to our BTEC units so is essential'***, whilst other students who were completing their Extended Project Qualification (EPQ) in project time felt the benefit of using PBL to target multiple outcomes at once.

3. During phase 1, 466 surveys were completed by students from eight UTCs. Completion rates ranged from 12 students per UTC to 132 students per UTC. During phase 2, 200 surveys were completed by students from six UTCs, with completion rates ranging from 9 students per UTC to 63 students per UTC

Transferable 'work-ready' skills

The young people interviewed recognised that they were developing 'work-ready' skills, which they could transfer to a range of settings after moving on from the UTC. One student described how: **'even if you have no interest in [the UTC specialism], doing PBL will give you a base set of skills that will be beneficial for you in the future'** (Year 13 student). Students' survey responses also reflected this awareness: 60 per cent strongly agreed or agreed with the statement **'attending the UTC has helped me develop employability skills'**.

Learning how to behave in the workplace was a central theme for students. They said that projects replicated how employees operated in the workplace, rather than how students learnt in traditional education settings: **'It gives you an experience of how you should be behaving – to be mature and step up...you had to watch your mouth and act the part; it's the real world'** (Year 13 student). Moreover, students were aware that this strengthened their communication and interpersonal skills. One Year 11 student commented: **'It helped me work with other people that I didn't know and had never worked with before'**.

Students believed that their problem-solving abilities had been fostered by a culture of independent learning in their UTCs. They felt that they were encouraged, and given freedom, to both undertake self-study and work in teams: **'You don't get told what to do; you work as a team and get to figure out problems in your own way'** (Year 13 student).

Students felt that they had enhanced their employability skills and, furthermore, saw this as an advantage over young people from more traditional education settings. Their experiences at the UTC and working with employers had given them material to use in both job and university applications and interviews. For example, one Year 13 student explained: **'Project work gives us skills that we haven't had before, so we'll have skills that other people don't have that we can put on our CVs'**. Another Year 13 student described how the experiences were useful for university application: **'We can show what we've been actively involved in, much further than just A levels. That helps set us apart from others who have not done PBL. It shows that we've taken initiative'**.

Moreover, some students provided detailed accounts of how they had acquired technical and transferable skills. For example, a Year 13 student who had undertaken a project in 3D printing discussed its impact on her:

[The 3D project] helped me massively, almost more than anything else in the college because I went to an interview for an apprenticeship in engineering. I was able to say that I have done 3D printing, worked in a team. It's given me workplace skills as well as college skills. Managing time, meeting deadlines. I have managed to say a lot because of that at interviews.

Students also shared their attitudes towards PBL, noting that they were most satisfied when there was a range of projects to choose from and they had flexibility to decide what to work on. Students found projects more useful when they were relevant to their future destinations. In addition, generally, they felt more positive about projects with shorter time scales, noting that it could be difficult when projects did not have a clear end date. Some students suggested that projects should be shorter and more intensive.

Other attitudes and attributes

As discussed in the phase 1 report, phase 2 students felt that attending the UTC benefits their confidence, motivation and engagement.

Although survey responses reported below (section 3.2) suggested that students had low levels of confidence about aspects of their school performance, the young people interviewed at the three UTCs in phase 2 noted how experiences, such as being offered leadership responsibilities and being exposed to new situations, had increased their confidence in dealing with a range of scenarios as illustrated below.

'The biggest thing I've got is confidence. The number of times PBL has put me in front of different people. Scientific poster events and presentations in front of big audiences' (Year 13 student).

'Meeting employers was very good – it reduced the intimidation you might feel in the future because you have already met employers as part of projects...we're used to talking to senior people, like heads of faculties at universities' (Year 13 student).

‘I’ve been given more leadership responsibilities through CCF (Combined Cadet Force). That’s helped my confidence to develop. At the beginning, I never had any confidence in myself; now, I lead a group of cadets...I would not have got this if I’d gone anywhere else’ (Year 13 student).

Moreover, 58 per cent of students surveyed strongly agreed or agreed with the statement ‘attending the UTC has helped me feel more confident about what I can achieve at school’, and 61 per cent strongly agreed or agreed that attending the UTC had helped them to participate more in lessons. This would appear to indicate that PBL, including interactions with employers, has enabled young people to develop their confidence and that this, in turn, may have supported their school work.

In addition, students reported being more motivated to study because they could see the relevance and real world implications of their projects, as one Year 13 student explained: ***‘The fact that it is a real-life problem – not just something they are making up for us. You feel you can really make an impact and improve something’***. Similarly, students were trusted to be independent in their work, and thus felt a greater sense of self-motivation. One Year 11 student noted: ***‘You were trusted to just get on with it and manage***

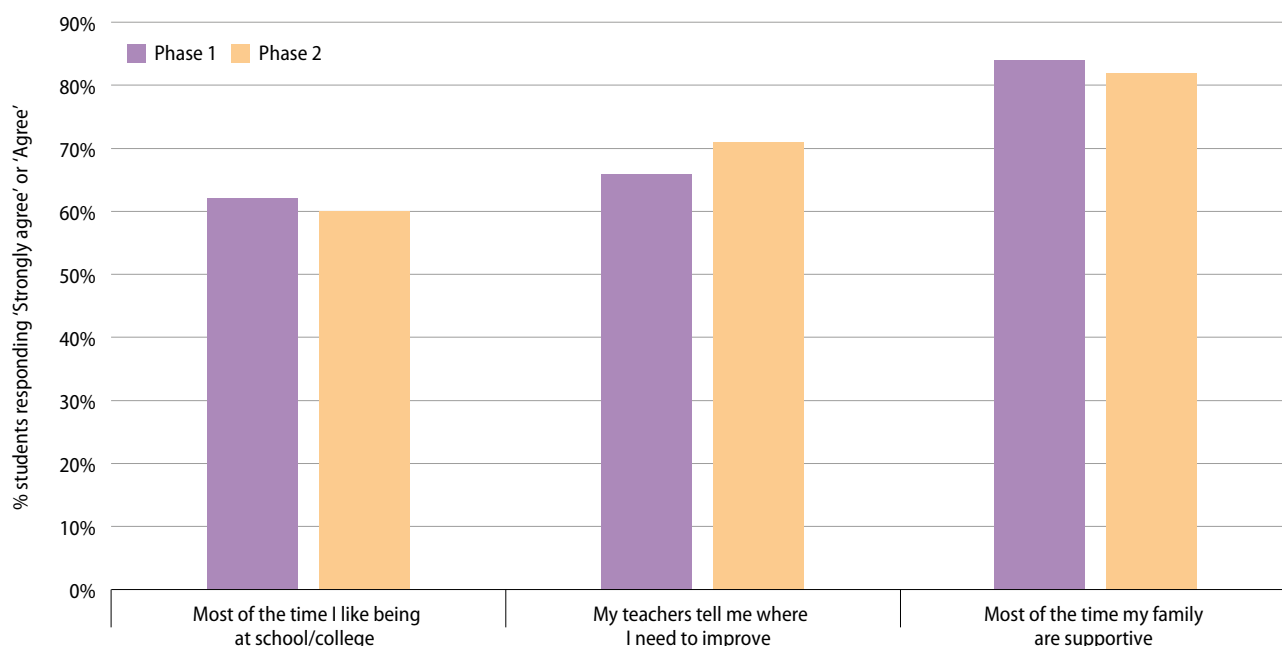
your own project’. Opportunities to publish work in a school science journal also motivated students at Liverpool UTC, as illustrated by one Year 11 student: ***‘If you get your work and results published, it gives you that sense of recognition’***.

Generally, students tended to find the hands-on approach to learning more engaging. They appreciated the breadth of work carried out at the UTCs and felt that it provided them with the opportunities to apply skills: ***‘PBL gives you the opportunity to do stuff you are really interested in, not just what’s in the curriculum...you’re enjoying discovering things for yourself’*** (Year 13 student).

ATTITUDES TOWARDS EDUCATION, HOME LIFE AND THE FUTURE

In phase 2, the majority of students felt positively towards education, with 60 per cent strongly agreeing or agreeing that they liked being at school/college most of the time (phase 1: 62 per cent). The majority felt supported by teachers: 71 per cent strongly agreed or agreed that their teachers told them where they needed to improve (phase 1: 66 per cent). Similarly, 82 per cent of students strongly agreed or agreed that their family were supportive most of the time (phase 1: 84 per cent) (figure 1).

Figure 1: THE MAJORITY OF STUDENTS FELT POSITIVELY TOWARDS THEIR EDUCATION AND HOME LIFE



Source: Phase 1 (2017) 466 student responses; phase 2 (2018) 200 student responses.

Aligned with findings at phase 1, the majority of students recognised the importance of qualifications to their future, with 85 per cent agreeing or strongly agreeing that 'It is important to get qualifications to get on in life' (phase 1: 86 per cent), and 73 per cent agreeing or strongly agreeing that school is 'giving me the skills I need for my future' (phase 1: 75 per cent). Whilst students felt slightly less positive about their futures than those responding at phase 1, the majority still strongly agreed or agreed with the statement 'I feel positive about my future' (phase 1: 70 per cent; phase 2: 62 per cent).

In line with previous findings, over a third of students (37 per cent) expressed concerns with aspects of their life, agreeing or strongly agreeing that they feel stressed or anxious most of the time. This is a greater proportion than in phase 1 (30 per cent) (figure 2). Such findings could be related to the timing of the phase 2 survey, which was completed by students in the spring term of years 11 and 13; year groups which are naturally more stressful than years 10 and 12, given their focus on exams.

Responses to questions about school performance were also less positive at phase 2: 16 per cent strongly disagreed or disagreed that they were doing well at school/college compared to eight per cent at phase 1. Furthermore, 40 per cent strongly agreed or agreed that

other people always do things better than they do, compared to 28 per cent at phase 1 (figure 2). This could be related to a general downward trend in the confidence and happiness of young people in recent years (The Prince's Trust, 2018). Previous research (Galton *et al.*, 1999; Lord and Jones, 2006) has also shown that children's attitudes are most positive in the early years of schooling and tend to become more negative as they grow older.

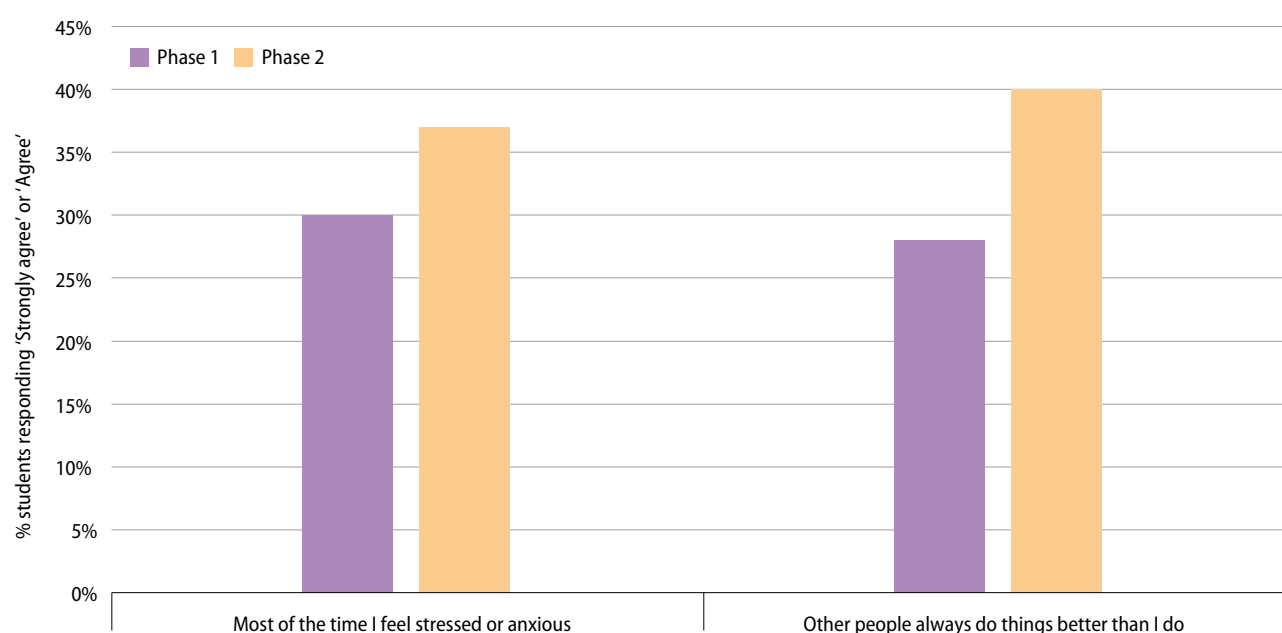
FUTURE DESTINATIONS AND PATHWAYS

Proposed destinations and pathways

Students' proposed future directions were typically aligned with the specialism of their UTC. For example, several students at Reading and Aston UTCs were interested in pursuing further training related to engineering, whilst students from Liverpool UTC were typically keen to take science-based paths.

Year 13 students had a clearer idea of their intended future destinations and pathways than year 11 students, as expected, with one year 11 student explaining: *'I don't have any firm career ideas yet, but after doing all these projects, I feel like I want to go into something science-based and I would like to go to university'*.

Figure 2: SOME STUDENTS EXPRESSED CONCERNS WITH ASPECTS OF THEIR LIFE



Source: Phase 1 (2017) 466 student responses; phase 2 (2018) 200 student responses.

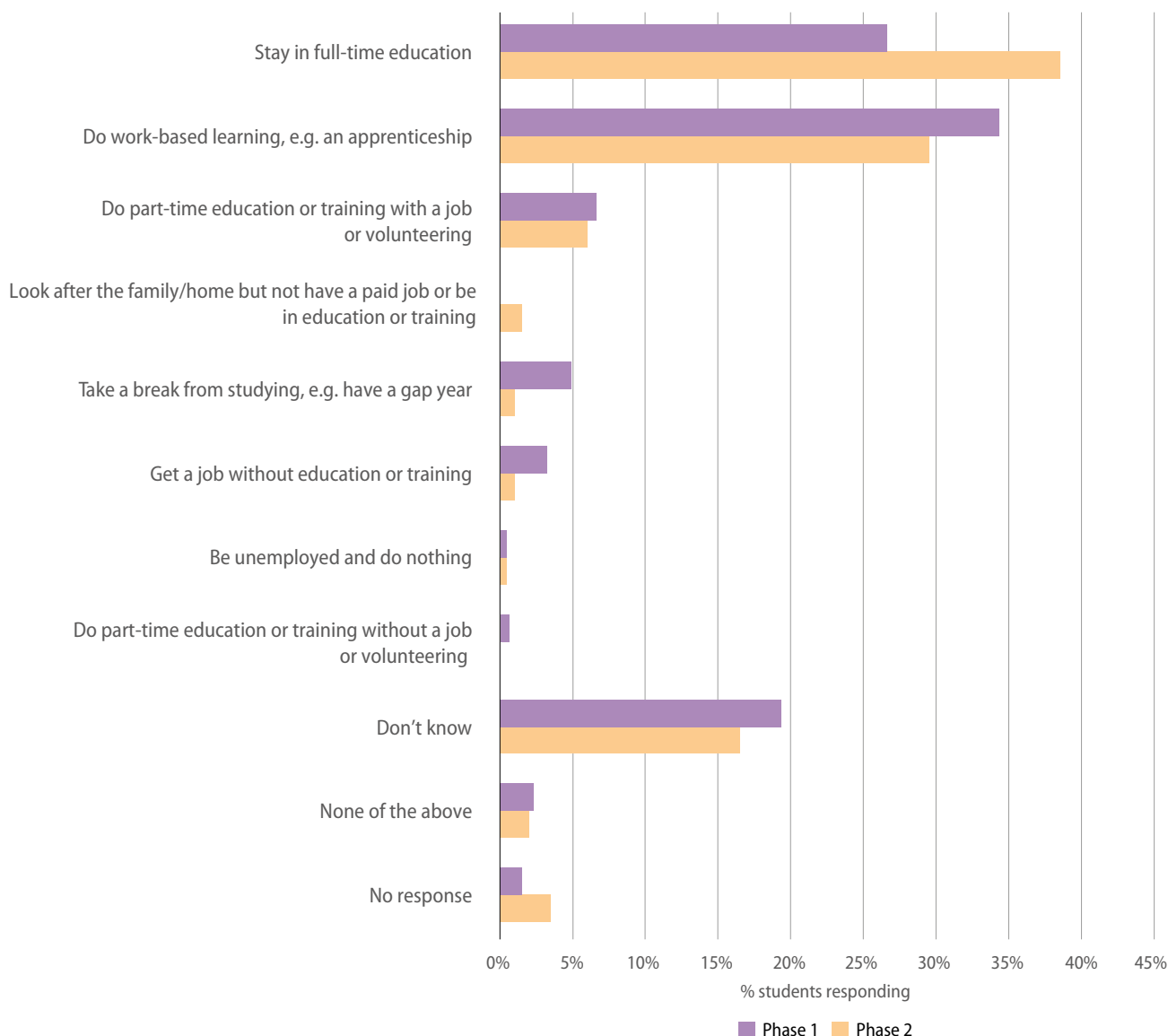
Results from the student survey in phase 2 showed that most students wanted to stay in education, employment, or training after leaving their UTC: 39 per cent wanted to stay in full time education, and 30 per cent wanted to do work-based learning such as an apprenticeship. As can be seen in Figure 3, the proportion of students who did not know what they wanted to do after leaving the UTC was lower in phase 2, possibly as a result of students being closer to the end of their time at the college. Students in phase 2 were also more likely to be hoping to stay in full-time education than do an apprenticeship, reversing the trend found at phase 1.

Impact of attending a UTC

Students felt that attending the UTC had facilitated their opportunities and enhanced their skills for the employment market which they would otherwise not have had. This was reflected in the student survey: 60 per cent of students strongly agreed or agreed that attending the UTC had helped them feel more confident about what they could do after leaving school.

Projects had enabled students to build networks of employers and partners, making it easier for them

Figure 3: THE MAJORITY OF STUDENTS WANTED TO STAY IN EDUCATION, EMPLOYMENT, OR TRAINING AFTER LEAVING THEIR UTC



Source: Phase 1 (2017) 466 student responses; phase 2 (2018) 200 student responses.

to find work in the future. As one Year 13 student commented: ***'Projects have given me my own networks and contacts...the guy who was teaching me has offered me an apprenticeship that wasn't advertised. It's more focused on the units I want to do. It's helped with my future career'***.

Students did not necessarily see UTC specialisms as narrowing their future options. In fact, many felt that attending a UTC had opened doors to other possibilities as illustrated by the following observations from Year 13 students:

I want to do civil engineering in the future, but don't want to narrow my experiences now, so I did a manufacturing project...for the experience of it, as well as joining the CCF. This has given me more potential routes and more opportunities to do things I enjoy.

We all came here because we loved science – we may not have been completely sure exactly what we wanted to do as a career, but we wanted to feed the knowledge...PBL lets you look further into what's out there.

Furthermore, many students thought PBL had given them inspiration and motivation to pursue their ambitions, and students were happy to have been able to focus their attention on what they were good at. Two Year 13 students observed:

Before I started working on the plane, I wanted to be an interior designer or civil engineer, but it's changed completely after this. I want to be an aerospace engineer now.

When I first joined the school, I thought I wanted to go into medical research. Working in the labs has made me realise I don't want to go into research, I want to be a medical practitioner.

However, as reported in phase 1, more careers education and guidance would be appreciated by some students: just over a fifth (22 per cent) strongly disagreed or disagreed with the statements 'adults in my school help me to plan for my future' and 'I know where to get careers advice'.

The destinations of students¹

During November 2018, we contacted the young people involved in the phase 2 case studies to ascertain their current destinations. In total, we received destination data for 11 young people (out of 24 young people who gave their permission to be followed up), five of whom were in Year 13 and six of whom were in Year 11 in the 2017/18 academic year. Of those who had been in Year 13, all five were now at university. Three of these students provided us with their undergraduate course details, with all three studying STEM-related subjects.

National destinations data (DfE, 2018) are available for the 2015/16 cohort of students and include the destinations of students from 27 UTCs. According to this dataset, 38 per cent of UTC Key Stage 5 students who left in 2015/16 were studying at university in 2016/17 (compared to 50 per cent of all state-funded schools and colleges) and 21 per cent had gone into apprenticeships (compared to just six per cent for all state-funded schools and colleges). Proportions progressing to other destinations (e.g. employment) were broadly similar. These findings, while for a different cohort of students, reflect the destination aims of the Year 13 students who responded to our survey in phase 2, with 39 per cent wanting to go into full-time education and 30 per cent wanting to go into work-based learning such as apprenticeships. This suggests that UTCs are supporting students to consider a range of options post-18, in particular apprenticeships. However, one of the university respondents who provided destinations data felt the advice had been too focused on the apprenticeship route, commenting: ***'80 per cent of the UTC advice had been related to apprenticeships and so [I] had to do [my] own research'***. Another university student, from a different UTC also stated that he had to do his own research in order to find his course. A final university student reported feeling well-informed about post-18 options.

The six Key Stage 4 students we subsequently collected destinations data on were all continuing in education, with five having remained at their UTC and one having moved to a local sixth-form college. Two of the students

1. This data is not representative of the UTC cohorts and is included to provide illustrative feedback from students.

who remained at their UTC specifically commented that they felt well-informed about their post-16 options. The

one student who moved institutions carried out his/her own research on the possible alternative routes.

KEY FINDINGS

- Students were aware of the impact of projects and employer engagement on their academic learning and technical skills. Students across year groups noted how their classroom-based and project-based learning could support one another. They appreciated increased freedom from curriculum guidelines, and the opportunities this gave them for seeing new perspectives.
- The development of numerous ‘work-ready’ skills was noted by students. These included learning appropriate workplace behaviour, communication and interpersonal skills, and problem-solving abilities. Students were aware that these skills were transferable, and could be used to support both job and university applications and interviews.
- As reported in the phase 1 report, students interviewed during phase 2 also felt that attending the UTC had benefitted their confidence, motivation and engagement. Students identified that this may have been fostered through facing new situations, being offered leadership responsibilities, and seeing

the relevance and real-world implications of their work.

- Responses from young people completing the survey should be interpreted with caution due to the changing makeup of the sample from one year to the next (e.g. some UTC students responding in phase 1 did not respond in phase 2)². Mindful of this, similar responses were collected across the phases, showing that most students felt positively about education in general. Students in phase 2 were slightly more likely to express concern about reaching their full potential.

Students’ proposed future destinations were generally aligned with the specialism of their UTC. Most wanted to stay in full-time education, employment, or training after leaving college. UTCs are supporting students to consider a range of options post-18, in particular apprenticeships.

2. During phase 1, 466 surveys were completed by students from eight UTCs. Completion rates ranged from 12 students per UTC to 132 students per UTC. During phase 2, 200 surveys were completed by students from six UTCs, with completion rates ranging from 9 students per UTC to 63 students per UTC.



A young man with short brown hair and glasses, wearing a blue work jacket with a logo, is focused on working on a metal part on a large, dark, circular workbench. He is using a tool to work on a cylindrical metal piece. Several other similar metal pieces are scattered on the workbench. The background shows a workshop environment with various tools and equipment. On the left side of the image, there are five overlapping white circles of varying sizes.

4. PROMISING PRACTICE GUIDANCE ON EMPLOYER ENGAGEMENT AND PBL

Sharing experiences across institutions and developing a community of good practice will grow a culture where young people will be given the opportunity to enhance their skills, knowledge and resilience for the workplace.



4. Promising practice guidance on employer engagement and PBL

Based on experience of using models of project-based learning (PBL), case-study UTC senior leaders, staff, young people and their community/employer partners outlined practice perceived to be effective at improving students' knowledge, skills and readiness for the world of work. This is detailed below.

START WITH THE FOUNDATIONS:

1. ensure that members of the school senior leadership team take a strategic lead and support the development of PBL and play a significant role in growing and progressing employer input into the projects
2. ensure staff have ring-fenced time to work with partners and to take ownership of projects
3. where possible, recruit staff with knowledge of how their industry sector works who can work consistently on collaborative cross-curriculum projects
4. strengthen staff motivation and engagement through, for example: CPD programmes; access to research and evidence so that staff understand the value of practical project-orientated learning; the links between education and employment; the nature of different approaches to learning such as facilitating and scaffolding learning; the importance of employer input; and the reciprocal nature of relationships with employers
5. develop a central database to keep track of dialogue with partners and invest time in order to maintain relationships and communication channels with partners; include consistent known points of contact to enable efficient communication
6. research and understand the local economy (business, industry and service profile), and community so that you can approach the companies/organisations with best fit to your sectors and projects and visibly add value to young people and the community.

BUILD THE PROJECT:

1. start slowly and develop PBL on a continuum from 'contextual' to 'moderate' to 'profound'¹ employer input that builds staff confidence, technical skills and expertise
2. create a broad range of authentic, real-world project ideas and opportunities to appeal to young people's interests
3. where possible, ensure that employers have a central role from inception to final presentation and that the project is part of the curriculum
4. include employers early on in the PBL planning stages and develop a structured approach to project design and delivery based on extensive communication with partners to ensure that young people develop technical skills relevant to the workplace
5. design PBL and integrate it into specialisms and the curriculum while maintaining its distinctive characteristics such as student ownership, self-direction and team work
6. enable connection between the curriculum and employers so that students can 'make sense' of the curriculum by, for example, business partners providing real-world practical settings, scenarios and challenges
7. secure young people's project buy-in and full understanding that successful completion of the project, with public recognition, will enable them to gain knowledge and skills to 'stand out' in future.
8. ensure there are visible celebrations of success at the end of the project.

WHEN IN COMMUNICATION WITH EMPLOYERS:

1. be proactive and reach out to local potential business partners
2. make sure that local businesses are aware of the ethos and purpose of the school or college and the ways in which they can benefit from getting involved
3. identify current skills and knowledge needed by employers and keep up-to-date
4. support employers to understand that investing in PBL with staff time and commitment can be mutually beneficial to the school and partners. It can yield high returns in terms of their future skilled workforce and they can contribute in a way and at a level that suits them
5. demystify the process of PBL and education as much as possible so employers are very clear about their role and what value they can add
6. ensure employers have a basic understanding of the qualification within which the project sits
7. encourage employers to send representatives who can relate to young people.

Interviewees across both phases of this evaluation felt that working in partnership with employers, and developing PBL, was a very effective way to engage, motivate and prepare young people for the workplace. At the same time, it connected practitioners to the real world of work and provided businesses with the future technical skills needed for a productive future.

Finally share experience across institutions and develop a community of good practice

1. 'Contextual': where partners provide information about the workplace and activities that help to inform young people about technical and transferable knowledge and skills. 'Moderate': where partners are involved in PBL but are not playing a significant role. 'Profound': where partners typically take ownership of a project; input into formative assessment; influence the delivery of curriculum components; and inform teaching and learning with specialist, current, technical skills and knowledge.

5. Conclusions and recommendations

Learning through projects, informed by employers and partners and aligned to curriculum standards and current business practice, was seen as an effective way to engage young people and prepare them for the modern workplace.

CONCLUSIONS

Evidence from the three phase 2 UTCs endorses and provides further detail to the phase 1 findings (McCrone *et al.*, 2017); that these UTCs have developed ways to invigorate learning resulting in students seeing its relevance to their future lives. They have developed strategies such as:

- working in collaboration with employers and partners, at different levels, to improve relevance of the curriculum to modern workplace practice
- devising flexible approaches that allow employers to contribute in ways that suit them
- formulating a dynamic range of projects to support key industrial sectors.

These strategies have been enabled, and supported, by putting underpinning processes and behaviours in place. Examples include:

- senior leaders playing an active and leading role
- researching and understanding the local economy and employers
- clarifying and explaining the processes of engagement so employers are clear about what they have to do
- establishing communication channels with employers and partners to develop PBL relevant to their business needs

- having a central database of partners so UTC staff are up-to-date with partner communications
- where possible, employing staff with knowledge of the business sector and the communication skills to draw out the benefits of PBL to employers and young people
- training staff to strengthen commitment, promote awareness of the importance of infusing projects with the world of work and develop practical ways to achieve effective PBL.

Having these processes and behaviours in place helps to overcome challenges such as securing: employers' (including SMEs') ongoing involvement; the understanding and commitment of UTC staff; and young people's engagement and motivation.

Students recognised that the projects and employer engagement benefitted their academic learning, technical and 'work ready' skills. They were aware that they were acquiring appropriate workplace behaviour, communication and interpersonal skills, developing their problem-solving skills as well as learning industry-relevant skills and knowledge. Additionally, UTC staff interviewees pointed out that young people's confidence had improved through working with employers, their understanding of the way the world of work operates had progressed, and their decision-making was considered to be better informed.

RECOMMENDATIONS

In order to further develop PBL and ways of working with external partners such as employers, other UTCs, schools and colleges should:

- research and understand their local economy and employers
- analyse the findings and link them to curriculum specialisms
- reach out to employers, explain how engaging in education will benefit them and ensure that they value and respect employers' time and their contributions on an ongoing basis
- develop staff training so they value the importance of employers' contributions to invigorating learning in the classroom and preparing young people for their future working lives

- set up processes and behaviours to support the culture change whereby partners are seen as integral to a young person's education

- secure young people's buy-in by enabling them to gain hands-on experience in their chosen sector and celebrating their project achievements.

Chapter 4 outlines promising practice guidance on employer engagement and PBL in detail.

Finally, sharing experiences across institutions and developing a community of good practice will grow a culture where young people will be given the opportunity to enhance their skills, knowledge and resilience for the workplace.



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Appendices

SAMPLE CHARACTERISTICS

The following tables summarise sample characteristics:

Table 1 provides key background data for the sample, including all ten UTCs from phase 1.

Table 2 provides a comparison of background data between the ten UTCs, the population of all UTCs, and all schools.

Table 3 provides a comparison of attainment data between the ten UTCs, the population of all UTCs, and all schools.

Such tables were also presented in the first report (phase 1). These tables present the same information one year on.

Table 1: BACKGROUND DATA FOR THE SAMPLE OF 10 UTCS

BACKGROUND DATA FOR UNIVERSITY TECHNICAL COLLEGES SELECTED FOR THE SAMPLE												
UTC	KS2 Average Point Scores Year 10 2015/16 intake	Average Progress 8 measure (2016/17)	Average Attainment 8 score per pupil (2016/17)	Average point score per academic KS5 entry (2016/17)	Average point score per tech level KS5 entry (2016/17)	Average point score per applied general KS5 entry (2016/17)	Percentage of pupils eligible for FSM at any time during the past 6 years (2016/17)	Percentage of pupils with English not as first language (2016/17)	Percentage of girls on roll (2016/17)	Percentage of eligible pupils with SEN support (2016/17)	Percentage White British ethnic background (2016/17)	Overall absence rate (2016/17)
1	28	-0.78	39.10	22.46	43.63	**	52%	27%	13%	13%	9%	6%
2	29	-0.32	44.50	8.74	42.92	29.36	23%	0%	29%	11%	99%	5%
3	27	-0.31	37.90	21.21	34.28	*	48%	37%	13%	16%	23%	11%
4	29	-0.83	38.60	30.88	**	40.82	51%	15%	64%	9%	58%	6%
5	28	-1.08	36.10	18.49	36.40	47.50	9%	3%	17%	3%	86%	7%
6	28	-1.29	34.00	23.28	39.60	33.06	34%	3%	62%	7%	73%	10%
7	29	-0.84	40.20	24.52	30.64	39.13	9%	2%	17%	16%	91%	5%
8	28	-0.46	42.40	16.99	38.30	**	25%	3%	15%	17%	92%	7%
9	29	-0.30	48.20	26.56	42.33	41.67	22%	24%	12%	12%	56%	4%
10	29	-1.23	37.20	13.17	29.67	**	28%	2%	40%	9%	86%	11%

*Suppressed - where pupil numbers are less than 5, values are suppressed in DfE statistical releases

**No entries - where no pupil were entered in the 2016/17 academic year

i) KS2 APS were calculated from pupil level data for individuals in the Year 10 2015/16 cohort using the National Pupil Database

Table 2: BACKGROUND CHARACTERISTICS DATA

TABLE COMPARING ALL SCHOOLS, TO ALL UNIVERSITY TECHNICAL COLLEGES, TO UNIVERSITY TECHNICAL COLLEGES IN THE SAMPLE				
		All schools	All UTCs	Sample UTCs
Pupils eligible for FSM at any time during the past 6 years (2016/17)	Mean	29%	32%	30%
	Valid N	3157	42	10
Pupils with English not as first language (2016/17)	Mean	16%	10%	12%
	Valid N	3167	42	10
Percentage of girls on roll (2016/17)	Mean	49%	23%	28%
	Valid N	3167	42	10
Percentage of eligible pupils with SEN support (2016/17)	Mean	11%	14%	11%
	Valid N	3167	42	10
Percentage White British ethnic background (2016/17)	Mean	69%	67%	67%
	Valid N	3167	42	10
Total N		3278	49	10

i) The table above includes data for all through, middle deemed secondary and secondary schools in England of the following types: Academy Converter, Sponsored Academy, Community School, Foundation School, Free School, Studio School, University Technical College, City Technical College, Voluntary Aided School, Voluntary Controlled School. Schools were included if their statutory age range enabled them to have a KS4 cohort.

ii) Data refers to all schools open as of the beginning of the 2017/18 summer term (16/04/2018). Where schools were new, they appear in the 'Total N' statistic but have no 2016/17 data for calculation of averages. The 'Valid N' statistic indicates the number of schools with background data included in calculations. Schools which had converted type since data was released were matched to their predecessor school to reduce the amount of missing data.

iii) Pupil characteristics data was downloaded from the January 2017 Schools, Pupils and Characteristics Statistical First Release.

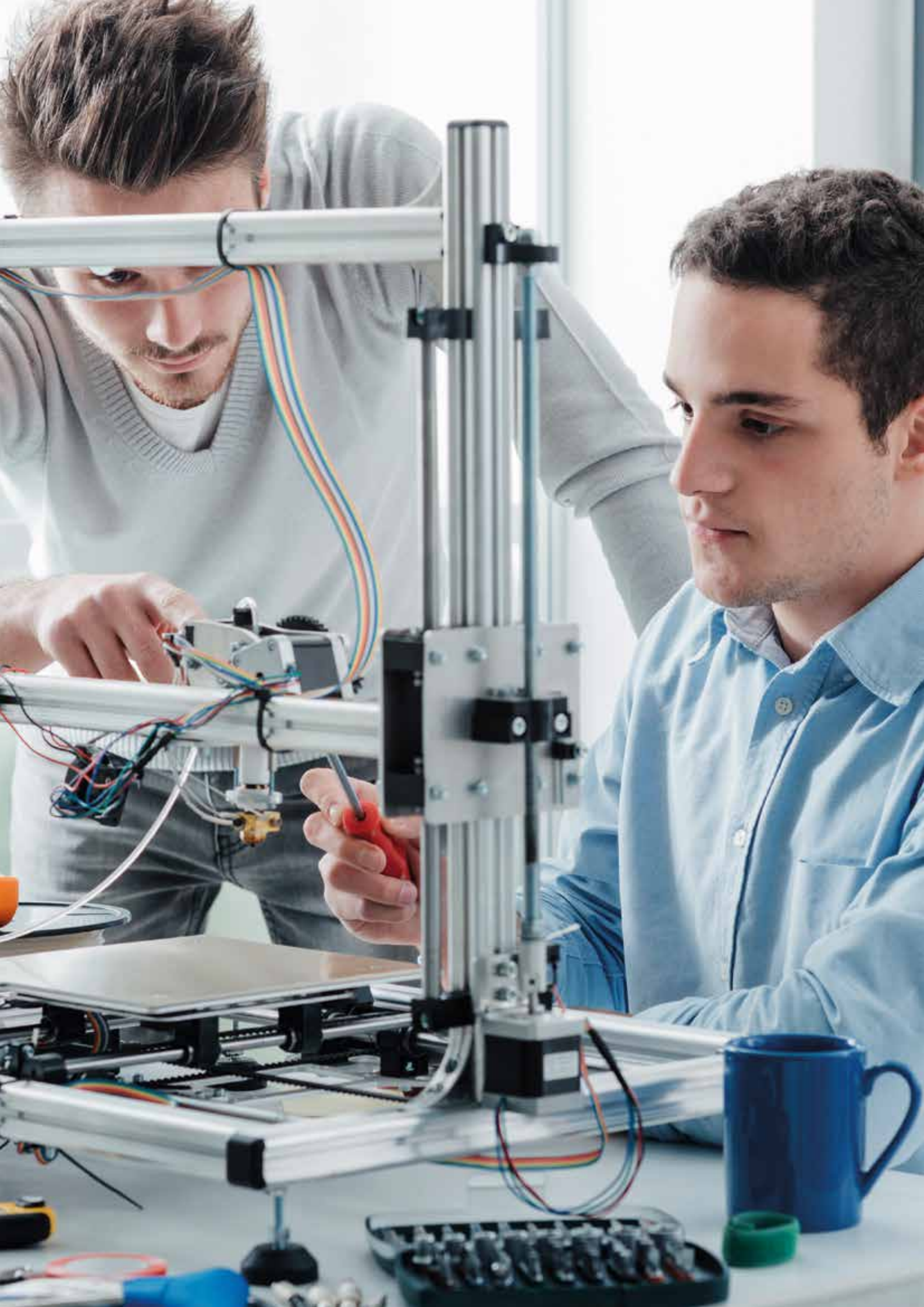
Table 3: BACKGROUND ATTAINMENT DATA

TABLE COMPARING THE ATTAINMENT OF ALL SCHOOLS, TO ALL UNIVERSITY TECHNICAL COLLEGES, TO UNIVERSITY TECHNICAL COLLEGES IN THE SAMPLE				
KS4 ATTAINMENT		All schools	All UTCs	Sample UTCs
Average Progress 8 measure (2016/17)	Mean	-0.01	-0.89	-0.74
	Valid N	3034	31	10
Average Attainment 8 score per pupil (2016/17)	Mean	47.08	37.27	39.82
	Valid N	3040	31	10
Total N		3153	38	10
KS5 ATTAINMENT		All schools	All UTCs	Sample UTCs
Average point score per academic KS5 entry (2016/17) (all academic qualifications, including A levels)	Mean	29.10	19.92	20.63
	Valid N	1922	31	10
Average point score per tech level KS5 entry (2016/17) (vocational qualifications)	Mean	38.49	35.81	37.53
	Valid N	646	27	9
Average point score per applied general KS5 entry (2016/17) (broad general qualifications)	Mean	39.23	34.83	38.59
	Valid N	1423	16	6
Total N		3263	48	10

i) The table above includes data for all through, middle deemed secondary and secondary schools in England of the following types: Academy Converter, Sponsored Academy, Community School, Foundation School, Free School, Studio School, University Technical College, City Technical College, Voluntary Aided School, Voluntary Controlled School. Schools were included if their statutory age range enabled them to have a KS4 cohort.

ii) Data refers to all schools open as of the beginning of the 2017/18 summer term (16/04/2018). Where schools were new, they appear in the 'Total N' statistic but have no 2016/17 data for calculation of averages. The 'Valid N' statistic indicates the number of schools with background data included in calculations. Schools which had converted type since data was released were matched to their predecessor school to reduce the amount of missing data.

iii) Attainment figures were downloaded from the DfE performance tables. Where 5 or fewer students were entered for exams in a school, these results were not included in calculation of averages. If the 2016/17 KS4 or KS5 cohort had no pupils, schools had no 2016/17 attainment data.





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