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The Royal Academy  
of Engineering



University  
Technical  
Colleges

# Respected

**Technical qualifications  
selected for use in University  
Technical Colleges**  
**Matthew Harrison**

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Report written by Professor Matthew Harrison  
with participation in the research by a panel  
of school leaders and advisory group drawn  
principally from the National Committee for  
14-19 Engineering Education which is convened  
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1. [http://www.thedataservice.org.uk/statistics/other\\_statistics\\_and\\_research](http://www.thedataservice.org.uk/statistics/other_statistics_and_research)

## Section 1

### Introduction

**In March 2011, the Baker-Dearing Trust in conjunction with Edge asked the Royal Academy of Engineering to identify the technical qualifications in science, technology, engineering and mathematics (STEM) that would be respected by the STEM community:**

- Alongside a suite of GCSEs as the technical component of the University Technical College (UTC) curriculum at Level 2.
- In combinations to form the core of the UTC curriculum at Level 3.
- Individually and in combinations in other schools and colleges.

The lists of qualifications shown in Section 3 have been identified through structured rationalisation of the lists of S,T,E,M qualifications identified in the FE STEM Data Project<sup>1</sup> and through partnership working between members of the STEM community and Awarding Bodies. The FE STEM Data Project provides classified lists of S, T, E and M qualifications compiled through an analysis of the *Register of Regulated Qualifications* and the *Learning Aims Database*. It allows an assessment of the S,T,E and M qualifications taken in the FE and Skills sector in England and is the most comprehensive examination of S,T,E,M qualifications to date. However, as the title suggests, it does not include S,T, E and M qualifications taken in schools and therefore the input from Awarding Bodies has been important to ensure that the most comprehensive as practicable set of candidate qualifications was considered for inclusion in the lists of respected technical qualifications.

It should be noted that both the *Register of Regulated Qualifications*, the national database of accredited qualifications, is dynamic and therefore new candidate qualifications could be added and current ones taken out of use. It does not include all available qualifications. Therefore the lists shown in Section 3 can only ever be indicative of what accredited qualifications are available and should be considered as such. However, the structured approach for identifying respected technical qualifications adopted here could be employed to assess new or further candidate qualifications.

## Section 2

### Methodology

#### General approach: balance of mitigated risk **Process overview**

No single qualification can guarantee good progression to further study or to employment for every learner but the risk of generally poor progression can be mitigated through careful assembly of combinations of qualifications taking national data and local context into account.

The final selection of both technical and general qualifications falls to the Principal Designate of a new UTC, acting on the advice of employer and University partners to be approved by the UTC Governors. However it is hoped that their job will be easier and results more consistent on account of the structured approach adopted here which has:

- been developed in a transparent way
- draws on multiple sources of evidence
- and has been led by members of the STEM community.

The process adopted here was co-developed by the STEM community through a series of meetings involving more than 50 stakeholders. The origins are with a panel of school leaders listed on the back cover. Members of the wider Advisory Group are also listed.

Finally, as noted in Section 1, no list of candidate qualifications will ever be complete as the qualifications market is dynamic with qualifications being added and removed all the time. Members of the STEM community have defined here an initial list of candidate qualifications explaining the rationale for inclusion. Awarding Bodies will always be free to put a case to individual UTCs for additions or substitutions using the same rationale.

A six stage process has resulted in the shortlists of qualifications shown in Section 3. These stages were:

#### **STAGE 1**

Set indicators of STEM community respect for the selection process

#### **STAGE 2**

Apply filtering criteria to the qualifications listed by the FE STEM Data Project to produce lists for S, T, E and M. Augment the lists in partnership working with the Awarding Bodies to ensure that the most comprehensive as practicable set of candidate qualifications are considered and inspected.

#### **STAGE 3**

Apply further detailed filtering on inspection of the specifications for candidate qualifications to further rationalise the lists.

#### **STAGE 4**

Apply combinations criteria to identify combinations of qualifications with particular national or local progression value and any qualifications that should only be included under restricted local circumstances.

#### **STAGE 5**

Gap analysis – discussion with Awarding Bodies, Sector Skills Councils, schools, employers and others to identify any omissions and gaps in the qualifications lists

#### **STAGE 6**

Check that all recommended qualifications meet the set indicators of respect in the STEM community.

## Detailed process

### STAGE 1

#### Indicators of respect in the STEM community

**Likelihood of progression** to meaningful employment (in both STEM and non-STEM occupations) or further study is identified as **the most important indicator** of respect for qualifications – although there are others offered such as wage return which signal how *valuable* a qualification is. Because likelihood of progression and wage return are context-dependent, a **risk-based approach** to the selection of qualifications is adopted here **taking local context into account**. Local context could include: combinations of qualifications on offer locally, local progression opportunities and agreements, employer engagement, use of apprenticeship, provision of work experience and so on.

Qualifications should be selected on the basis of **mitigated risk** where likelihood of progression is assessed in conjunction with any general qualifications taken (such as the GCSEs that make up the English Baccalaureate) and local context. The final selection is rightly left to individual learning institutions as only they can fully assess the context-dependent factors.

## At Level 2

The following indicators of respect have been identified in the course of this work, and tested at a large stakeholder meeting (including the Advisory Group listed on the back cover) on the 25th May 2011:

- Fitting with the UTC vision (Annex D), the likelihood of progression to further STEM study is given highest weighting. This means a significant component of mathematics and or science (including applied science, engineering science, technological science, computer science) in most learning outcomes (or assessment objectives). Learning outcomes for technical qualifications should be assessed alongside those provided by the GCSEs that are also taken.
- Preparation for STEM based apprenticeship is given high weighting (with preparation for Level 3 STEM apprenticeship given highest weighting). This means prioritising qualifications that are recognised as *Technical Certificates* in apprenticeship frameworks or as feeder qualifications / subsets of Technical Certificates. Care should be taken when delivering Technical Certificates as stand alone qualifications as they have been designed to be delivered within an apprenticeship framework.
- What is known about relative economic returns between classes of qualification is given medium weighting. Some key data are given in Annex A. The *option value* of Level 2 qualifications should be taken into account on a case-by case basis as certain qualifications may have no identified economic return in their own right but open up access to higher level qualifications that do.
- Qualifications that are known to promote a 'practical' delivery are given medium weighting. This means significant practical skills being sought in the assessment matrices.

### At Level 3

The requirement for prior subject knowledge and attainment (aged 5-16) is a given of course although great care should be taken when considering those working towards Level 3 without having achieved A\*-C in GCSE Mathematics or English. Achieving A\*-C in Mathematics and English GCSEs or equivalents are important goals because these qualifications commonly act as gatekeepers for progression in general as well as, for example, progression to STEM based apprenticeships. However resitting these GCSEs may not be the best option and use of equivalents should be considered. Beyond that:

- What is known about relative economic returns between classes of qualification is given high weighting when this is known. Some key data are given in Annex A.
- Strength of progression to Higher Education is given high weighting when it is known. This should not be solely based on UCAS tariff but should take account of subject and type of qualification.
- Preparation for Level 3 and 4/5 apprenticeship is given high weighting. This means prioritising qualifications that are recognised as Technical Certificates in apprenticeship frameworks or as feeder qualifications / subsets of Technical Certificates.

### Note on learners who are working towards Level 1:

Issues of respect for and the value of qualifications are equally important for learners who are unlikely to attain a full Level 2 qualification by the age of 16. Therefore, the following indicators are applied to qualifications offered in a UTC for learners working towards Level 1:

- Setting foundations for progression beyond Level 1 is given the highest weighting.
- Achieving A\*-C in Mathematics and English GCSEs or recognised equivalents are important goals as these learners progress to Level 2 because these qualifications commonly act as gatekeepers for STEM based apprenticeships and Level 3 technical qualifications. To work towards these, the use of Free Standing Mathematics qualifications (FSMQ) should be considered at either Foundation (Level 1) or Intermediate / Higher (Level 2) levels. *Using algebra, functions and graphs* and *Handling & interpreting data* would be particularly relevant to ongoing technical studies.
- The likelihood of progression to further STEM study at Level 2 is given high weighting. This means a significant component of mathematics and or science (including applied science, engineering science, technological science, computer science) in most learning outcomes.
- Preparation for STEM based apprenticeship is given high weighting. This means prioritising qualifications that are recognised as *Technical Certificates* in apprenticeship frameworks or as feeder qualifications / subsets of Technical Certificates. Illustrative examples of feeder qualifications are offered in Annex B.
- What is known about relative wage returns between classes of qualification is given medium weighting. Some key data are given in Annex A. The option value of Level 1 qualifications should be taken into account on a case-by case basis (certain qualifications will have no identified economic return in their own right but open up local if not national access to higher level qualifications that do).

2. Diminished returns – how raising the leaving age to 18 will harm young people and the economy; Alison Wolf, Policy Exchange, 2007

3. Engineering Graduates for Industry, The Royal Academy of Engineering, February 2010

## STAGE 2

### High level criteria: applied to qualifications database

As explained in Section 1, the qualifications considered for inclusion are those in S,T,E,M identified by the FE STEM Data project with further input from Awarding Bodies. To be considered, qualifications must:

- Must be publicly funded for, and legally available to, the 14-19 age group under consideration. At Level 2, must be publicly funded to the under 16s (as confirmed on the *Register of Regulated Qualifications*)
- Must be S,T,E or M (or related)
- Qualifications in mathematics should be considered distinct from qualifications in numeracy (classifying qualifications as 'numeracy' if the development of numeracy is the primary purpose of that qualification and the qualification is unlikely to support development in mathematics or a STEM related subject, without additional mathematical learning)
- Must be at an appropriate level (Level 2, Level 3 and potentially some Level 1 and Level 4 for certain learners)
- Must have a reasonable national community of practice (i.e. a critical mass of teachers and lecturers - signalled by having more than say 300 achievements in a typical year with more than 20 centres offering the qualification nationally). The work of the FE STEM Data Project can be used to identify the size of communities of practice in the FE and Skills Sector. For some qualifications, a much larger community of practice is available in the schools sector. Awarding Bodies can provide insight on this.
- Must fit into the required guided learning hours for UTCs (illustrated in Annex C adapted from discussions with Awarding Bodies and others).

## STAGE 3

### Detailed criteria: applied to qualification specifications and other documentation

The further refinement of these lists of S,T, E and M qualifications requires detailed inspection of qualification specifications, sample assessment materials and other evidence provided by the STEM community for each qualification.

Noting that this will always be subjective to a degree, the following attributes, identified by the panel of school leaders can be identified as part of a mitigated risk approach as providing support for the adoption of a particular qualification.

### Ethos

- Must fit with the UTC vision: evidenced by meeting the requirements in Annex D.
- Must distinguish between paper qualifications and real skills<sup>2</sup>: evidenced by assessment criteria that add weight to the acquisition of STEM knowledge, STEM skills, practical / technical skills, problem solving skills, analytical skills.
- Must accommodate a 'practical identity' as well as a 'technical identity': evidenced by content that prioritises practical / technical content.
- Must encourage creativity and ingenuity ('designerly behaviour'): evidenced by assessment criteria that accommodate a degree of flexibility and require solving of more open-ended problems.
- Must encourage experience-led approaches<sup>3</sup>: evidenced by employer engagement in qualification design and development.
- Must encourage co-development by employers and HE.

### Validity

- Preferably endorsed by professions: evidenced by approval of organisations licensed to assess applicants for professional registration (for example the Professional Engineering Institutions: IET, IMechE, ICE etc.)
- At Level 2, must provide credible progression opportunities when taken alongside core GCSEs in academic subjects: evidenced by research into apprenticeship framework requirements and entry requirements for Level 3 study. Exemplar 14-19 progression maps are shown in Annex B. Careful consideration of which optional units are taken is required. Careful consideration of the mathematical needs of learners is required.
- At Level 3, must provide credible progression opportunities, potentially taken alongside GCE A Levels in particular subjects: evidenced by Higher Education entry requirements (taking into account subject and qualification type as well as UCAS tariff points), higher apprenticeship framework requirements, wage returns evidence (key data shown in Annex A). Careful consideration of which optional units are taken is required.
- Must be a 'portable qualification' and therefore must include a significant transferable knowledge core: evidenced by significant STEM in key content and learning outcomes. Therefore must not be solely based on National Occupational Standards.
- Must be future-proof: evidenced by the content which should include material that deals with societal, economic and technological trends.

### Pedagogy

- Must encourage activities that are 'real projects', offering real/authentic learning and real work exemplification, not closed-ended or irrelevant training exercises: evidenced in sample assessment materials. These might be termed 'contextualised' projects.
- Must have a structure that encourages independent learning: evidenced by the range of tasks expected of learners.

### Assessment

- Must be rigorous: evidenced by the use of a mix of assessment methods: both external and internal. Outcomes should include: knowledge / knowledge acquisition, understanding outcomes, practical outcomes, applied outcomes.
- The application of practical / technical skills should be prioritised in the assessment: evidenced by appropriate weighting in the assessment criteria. Assessment matrices which give higher weighting to the quality of practical outcomes (realised artefacts, systems that actually *work* etc.) will inevitably lead to a more practical experience for learners as teachers strive to meet the requirements of the qualification specification.
- Assessment methodology should not be excessively bureaucratic.
- Contextual assessment (the application of subject knowledge to the solving of real problems) should be sought wherever practicable. The assessment practice emerging around the *Higher / Extended Project Qualification* may prove useful. Free Standing Mathematics Qualifications may prove useful.

Annex E offers some guidance on incorporating the above attributes into a mitigated risk based methodology for considering the adoption of a given technical qualification.

4. Further evidence on marginal wage returns to a range of vocational qualifications is given in - Returns to BTEC vocational qualifications, London Economics, October 2010

#### STAGE 4

#### Apply combinations criteria to identify combinations of qualifications with particular national or local progression value and any qualifications that should only be included under restricted local circumstances.

Often it is the combinations of qualifications taken that prove important for progression. When considering likelihood of progression in STEM the following should be considered:

- The S,T,E and M learning outcomes of technical qualifications should be assessed in conjunction with the science and mathematics learning outcomes from any GCSEs taken alongside.
- Certain qualifications may have particular local significance. For example, a narrowly occupational technical qualification may be expected to yield poor likelihood of progression nationally, but in some localities strong local employment prospects might increase the likelihood of progression. The risks associated with early specialisation are mitigated to some degree through careful combination with other more general qualifications.

Combinations of qualifications are particularly significant to those who are unlikely to attain at Level 2 in (STEM and non-STEM) courses they attempt aged 16. This is because the economic value of Level 2 vocational or occupational qualifications (single or in combinations) is known to be very low as demonstrated by their **average** wage returns (Annex A). Those who gain very few qualifications at Level 2 (particularly the core GCSEs shown in Annex C) will struggle to make the vital progression to Level 3 by the age of 19 and could be left with mostly Level 2 (or lower) vocational qualifications of little economic value.

Notwithstanding this, Annex A shows that some vocational qualifications offer **marginal** returns for people qualified at lower levels<sup>4</sup>:

*For males, even where NVQ2 is a person's highest vocational qualification, the marginal wage return is nil. The marginal return to NVQ2 for women is positively significant when compared to the earnings of low qualified (3%) and unqualified women (5%)... For females with NVQ2 as their highest vocational qualification we observe a positive marginal wage return in the distribution (2%), public admin/education/health (4%) and other services (8%) sectors and for males in construction (11%).*

*...The marginal return to most level 2 qualifications is positive and significant, particularly when the comparison group is made up of workers with no qualifications at all. This implies that level 2 vocational qualifications are particularly valuable, in terms of the wage returns they yield, for individuals who leave school with no qualifications at all or only low level academic qualifications.*

**Therefore**, when planning combinations of qualifications, particularly considering lower attaining learners, the following criteria for combinations should be followed:

- If an NVQ is to be included then it must be **clearly in support of or combined with** one or more vocationally related qualifications (VRQ) listed in Section 3 to promote general (non-occupationally specific) progression beyond Level 2. For lowest attaining learners it may be appropriate for the VRQ to be at Level 1 if that qualification has option value for progression to Level 2 (see examples given in Annex B). A carefully configured Extended Project Qualification should be considered as an alternative to an NVQ2 at age 14-16. Because of this complexity **no NVQ qualifications are listed for inclusion in Section 3.**
- Learners working towards Level 1 should be encouraged to concentrate on attaining in mathematics and English GCSE or equivalents and consideration should be given to Free Standing Mathematics qualifications at Foundation and Intermediate / Higher levels. This may require a focus on a smaller number or different combinations of qualification to facilitate this.

**STAGE 5****Gap analysis – discussion with Awarding Bodies, Sector Skills Councils, schools, employers and others**

As explained in Section 1, the qualifications offered to schools and colleges will change over time as new qualifications are added and others are discontinued. Therefore any list of qualifications cannot ever be deemed 'complete'. The Principal Designate and the Governors of a new UTC should undertake discussion with schools that have a technical specialism, Awarding Bodies and Sector Skills Councils to ensure greater completeness.

Finally, there will doubtless be instances where a particular need is not met by any existing qualifications. Consideration should be given to the creation of new qualifications in such cases with due consultation with Awarding Bodies and Sector Skills Councils,

The input from a the panel of school leaders, the Advisory Group and Awarding Bodies has been sought to ensure that the lists of candidate qualifications considered are as complete as practicable.

**STAGE 6****Check that all recommended qualifications meet the set indicators of respect in the STEM community**

The list of qualifications, resulting from Stage 1 – 5 and shown in Section 3 has been checked with those who ascribe respect and value to qualifications: employers and FE College and HE admissions staff. Members of the Advisory Group have provided this.

The final checks, to be undertaken by a prospective UTC, should be on a mitigated-risk basis and made with reference to schools and colleges that are successful with the listed qualifications. These can be easily identified using the FE STEM Data Project data. The following issues should also be investigated through structured interview:

- The availability of specialist teachers and instructors
- The availability of specialist technicians and support staff
- The availability of specialist equipment
- Learning spaces
- Timetabling issues
- Access to authentic learning opportunities (through live projects, interaction with practitioners in a particular field, visits to industrial environments, FE Colleges, Universities etc.)

## Section 3

### Selected technical qualifications

A team at the Royal Academy of Engineering led by Matthew Harrison in consultation with the Panel of School Leaders and members of the Advisory Group and with further input from Awarding Bodies has worked through the six stages described in Section 2 to produce the following lists of **technical qualifications** in S,T, E and M that would be *respected* by the STEM community:

- Alongside a suite of GCSEs as the technical component of the University Technical College (UTC) curriculum at Level 2.
- In combinations to form the core of the UTC curriculum at Level 3.
- Individually and in combinations in other schools and colleges.

These are qualifications that variously:

- Include significant compulsory STEM content
- Provide progression opportunities
- Have sufficient national communities of practice
- Provide positive economic return (where known)

Of course the final selection of both technical and general qualifications falls to the Principal Designate of a new UTC, acting on the advice of employer and University partners to be approved by the College

#### LEVEL 2 list

<b>BTEC First Diploma in Engineering</b> (Note 1)	EDEXCEL
<b>Certificate in Engineering and Technology</b>	EMTA
BTEC First Diploma in Construction	EDEXCEL
<b>Certificate in Engineering</b>	City & Guilds
BTEC First Diploma in Vehicle Technology (Note 2)	EDEXCEL
BTEC First Certificate in Engineering	EDEXCEL
BTEC First Certificate in Construction	EDEXCEL
<b>Certificate in 2D Computer Aided Design</b>	City & Guilds
14-19 Higher (Level 2) Diploma in Engineering (Principal Learning) (Note 3)	AQA / EDEXCEL / OCR
14-19 Higher (Level 2) Diploma in Construction & Built Environment (Principal Learning)	AQA / EDEXCEL / OCR
14-19 Higher (Level 2) Diploma in Manufacturing & Product Design (Principal Learning)	AQA / EDEXCEL / OCR
Higher (Level 2) Project Qualification	AQA / EDEXCEL / OCR
GCSE Design & Technology (Note 4)	AQA / EDEXCEL / OCR
GCSE Engineering	AQA / EDEXCEL
GCSE Electronics	AQA / EDEXCEL / OCR
BTEC First Diploma in Applied Science	EDEXCEL
Certificate in the use of Mathematics (GCSE level) – (Note 5)	AQA
<b>BTEC First Diploma in Engineering</b> (Note 1)	EDEXCEL

- **Bold** denotes approval for use in Apprenticeship framework(s)
- The order in which these qualifications are displayed is not significant.
- Awarding Bodies, other than those listed above may offer these qualifications or very close variants.
- The titles may change between Awarding Bodies and as current VRQ titles get revised to QCF titles.

5. Review of Vocational Education – the Wolf Report, Alison Wolf, March 2011

### Notes on Level 2 list

1. Both longer (Diploma) and shorter (Certificate) variants of qualifications are shown when these are both found to have sufficient communities of practice. In addition to the BTEC First in Engineering, consultation with Awarding Bodies identified alternatives: BTEC Level 2 Certificate in Engineering, BTEC Level 2 Extended Certificate in Engineering, BTEC Level 2 Diploma in Engineering (with variants in Maintenance, Manufacturing, Electronics)
  2. In addition to the BTEC First Diploma in Vehicle Technology, consultation with Awarding Bodies identified a suite of Technical Certificates on the automotive theme that populate the Level 2 IMI Vehicle Maintenance Repair Apprenticeship framework.
  3. The Principal Learning from 14-19 Higher Diplomas in Engineering, Construction & the Built Environment and Manufacturing & Product Design are too new to allow reliable assessment of progression and wage return. They are included along with the Higher (Level 2) Project Qualification as a result of the respect signalled by the significant, continuing and well documented employer and University input into these qualifications.
  4. GCSE Design & Technology is included for the well understood progression opportunities it offers, particularly when taken alongside other STEM GCSEs. Courses in *Resistant Materials*, *Electronics & Control Systems*, *Industrial Technology* and *Product Design* are the components of Design & Technology with the strongest links to complementary STEM subjects. However, these are also components with significant under-representation of female candidates and care should be taken to construct a combination of qualifications that is as free of gender imbalance as practicable. Design & Technology achieves this to a greater extent when all product areas are offered including *Food Technology* and *Textiles*.
  5. The AQA Certificate in the Use of Mathematics is included on the basis that it takes forward the contribution hitherto made by Free Standing Mathematics qualifications (FSMQ), positively endorsed by the Wolf Review<sup>5</sup>. Individual FSMQs such as the Intermediate / Highers in *Using algebra functions & graphs* and *Handling & interpreting data* should be considered.
- Qualifications with sufficient communities of practice that were considered for inclusion on the list but discounted are shown in Annex F. These include:
- **All NVQs for the reasons set out in Stage 4**
  - All ICT, computing and IT related qualifications (including the 14-19 Diploma) pending the outcome of the Royal Society *Computing in Schools* study.
  - Qualifications explicitly designed for *practitioners* or *users* in the workplace
  - Qualifications that are in S,T,E,M but do not fit the UTC vision (non-technical STEM qualifications such as those in animal care for example)
- In addition a larger number of qualifications with less than 300 annual attainments in the FE & Skills sector in England were discounted.

6. <http://www.engc.org.uk/education--skills/technicians/database-of-technician-qualifications>

### LEVEL 3 list

The preparation of the Level 3 list has benefited from the engineering profession's long and detailed experience of assessing Level 3 technical qualifications for registered technician status and for admission to Higher Education. It has therefore been possible to make some definite recommendations.

#### For progression to engineering Higher Education (not including work-based routes into higher learning):

BTEC 12 unit (Diploma) or 18 unit (Extended Diploma) Level 3 National Diploma *including both Mathematics for Technicians units* (EDEXCEL) **or**

14-19 Advanced (Level 3) Diploma in Engineering / Construction & Built Environment / Manufacturing & Product Design Principal Learning **plus:**

- Level 3 Extended Project Qualification (AQA / C&G, EDEXCEL, OCR)
- GCE A Level Mathematics or OCR Level 3 Certificate in Mathematics for Engineering

Alternatively or in addition, progression accords between a UTC and particular universities could be used to assist student progression when they attain particular grades in their Level 3 engineering studies.

#### For those seeking admission to engineering degree courses via a vocational or 14-19 Diploma based route where there is known to be significant competition for places.

BTEC 18 unit (Extended Diploma) Level 3 National Diploma *including both Mathematics for Technicians units* **plus**

- At least GCE A Level Mathematics or OCR Level3 Certificate in Mathematics for Engineering
- Ideally GCE A Level Physics
- Ideally GCE Further Mathematics to at least AS level.

**or**

14-19 Advanced (Level 3) Diploma in Engineering / Construction & Built Environment Principal Learning **plus:**

- Level 3 Extended Project Qualification
- At least GCE A Level Mathematics or OCR Level3 Certificate in Mathematics for Engineering
- Ideally GCE A Level Physics
- Ideally GCE Further Mathematics to at least AS level.

GCE AS or GCE A Level D&T / Chemistry / Electronics / Computing might also be included but not as a substitute for Mathematics. Advanced (Level 3) FSMQ such as *Working with Algebraic & Graphical Techniques* and *Modelling with Calculus* and the Level 3 Certificate in *Mathematical Techniques for Engineers* might also be included.

For progression to employment, all known wage return evidence such as that set out in Annex A should be taken into account. For progression to Apprenticeship, qualifications that are approved for Level 3 or 4/5 apprenticeship frameworks should be given priority noting that they are designed for delivery within an apprenticeship and not as stand alone qualifications.

In addition the engineering profession is explicit about the Level 3 qualifications that it respects through inclusion in the Engineering Council database of qualifications approved by its licensed professional engineering institutions as contributing towards Engineering Technician (EngTech) or ICT Technician (ICTTech) standard route registration<sup>6</sup>. This is a dynamic database which is searchable and includes both recently expired and currently available qualifications. More are added as they are approved. It should be noted that vocational qualifications are not sufficient on their own as all applicants for professional registration must be able to demonstrate they have acquired the necessary competence through substantial working experience.

### Engineering Council database of qualifications approved for EngTech or ICTTech

#### Approved qualifications - BUT WITHOUT UCAS TARIFF

City & Guilds Level 3 Certificate in Aeronautical Engineering	Approved by : IMechE
City & Guilds Level 3 Certificate in Electrotechnical Technology	Approved by : InstRE
City & Guilds Level 3 Certificate in Engineering	Approved by : ICME, IMechE
City & Guilds Level 3 Certificate in Engineering Construction	Approved by : IMechE
EAL Level 3 Diploma in Advanced Mechanical Engineering Principles	Approved by : IMechE
EAL Level 3 Diploma in Engineering and Technology (Progressive)	Approved by : ICME, IMechE
EDI Level 3 Certificate in Transport Engineering and Maintenance	Approved by : SOE

#### Approved qualifications - WITH UCAS TARIFF

EDEXCEL BTEC Level 3 Certificate in Engineering (QCF)	Approved by : IMechE
EDEXCEL Level 3 BTEC Certificate in ICT Systems and Principles for Apprentices (QCF)	Approved by : InstRE
EDEXCEL Level 3 BTEC National Award in Engineering	Approved by : ICME, IMechE
EDEXCEL Level 3 BTEC National Certificate in Building Services Engineering	Approved by : CIPHE
EDEXCEL Level 3 BTEC National Certificate in Civil Engineering	Approved by : ICE
EDEXCEL Level 3 BTEC National Certificate in Construction (NQF/QCF 3)	Approved by : ICE
EDEXCEL Level 3 BTEC National Certificate in Construction	Approved by : ICE
EDEXCEL Level 3 BTEC National Certificate in Electrical/Electronic Engineering	Approved by : IFE, IMechE
EDEXCEL Level 3 BTEC National Certificate in Engineering	Approved by : IMechE
EDEXCEL Level 3 BTEC National Certificate in Manufacturing Engineering	Approved by : ICME, IMechE
EDEXCEL Level 3 BTEC National Certificate in Mechanical Engineering	Approved by : ICME, IMechE
EDEXCEL Level 3 BTEC National Certificate in Operations and Maintenance Engineering	Approved by : IMechE
EDEXCEL Level 3 BTEC National Certificate in Vehicle Repair and Technology	Approved by : SOE
EDEXCEL Level 3 Certificate in Logistics Operations (QCF)	Approved by : InstRE
BTEC Level 3 Diploma Operations & Maintenance Engineering (QCF)	Approved by : IMechE
EDEXCEL BTEC Level 3 Diploma in Aeronautical Engineering (QCF)	Approved by : IMechE
EDEXCEL BTEC Level 3 Diploma in Construction & Built Environment (Specialist: Construction) (QCF)	Approved by : ICE
EDEXCEL BTEC Level 3 Diploma in Engineering (QCF)	Approved by : IMechE
EDEXCEL BTEC Level 3 Diploma in Mechanical Engineering (QCF)	Approved by : IMechE
EDEXCEL BTEC Level 3 Extended Diploma in Engineering (QCF)	Approved by : IMechE
EDEXCEL Level 3 BTEC Diploma in ICT Professional Competence (QCF)	Approved by : InstRE
EDEXCEL Level 3 BTEC National Diploma in Civil Engineering	Approved by : ICE
EDEXCEL Level 3 BTEC National Diploma in Civil Engineering	Approved by : ICE, IStructE
EDEXCEL Level 3 BTEC National Diploma in Construction	Approved by : ICE
EDEXCEL Level 3 BTEC National Diploma in Construction	Approved by : ICE
EDEXCEL Level 3 BTEC National Diploma in Engineering	Approved by : IMechE
EDEXCEL Level 3 BTEC National Diploma in Landbased Technology	Approved by : IAgRE
EDEXCEL Level 3 BTEC National Diploma in Manufacturing Engineering	Approved by : ICME, IMechE
EDEXCEL Level 3 Diploma in Civil Engineering for Technicians (ICE/QCF)	Approved by : ICE
Edexcel Level 3 BTEC National Diploma in Electrical/Electronic Engineering	Approved by : IFE, IMechE

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Other qualifications respected by virtue of being cited in the admission requirements for engineering degrees include

- **OCR Level 3 Certificate in Mathematics for Engineering**
- **STEM GCE AS and A Levels (including Design & Technology, Mathematics, Further Mathematics, Physics, Chemistry, Biology, Computing, Electronics)**

**BTEC Level 3 Certificate / Diploma in Applied Science** is also included on the basis of progression opportunities in science-based higher education and employment.

Consultation with Awarding Bodies identified a suite of Technical Certificates on the automotive theme that populate the Level 3 IMI Vehicle Maintenance Repair Apprenticeship framework as well as the BTEC Level 3 Extended Diploma in Aircraft Maintenance

Qualifications considered for inclusion of the list but discounted are shown in Annex G

## Section 4

### Further actions

During consultations with the Panel of School Leaders and the Advisory Group the following issues were identified that were deemed out of scope for the programme of work set out in Section 1 but worthy of consideration as part of any future work in this area:

- **Contextualised mathematics.**  
There was widespread recognition that Mathematics is a vital accompaniment to technical studies at all levels, but for students working towards Level 1 or 2 the current GCSE in Mathematics is not ideal. Further work is required to identify, or develop, contextualised Mathematics qualifications at Level 2 that have rigour and are recognised as equivalent to GCSE in all respects.
- **IT related qualifications.**  
Level 2 qualifications variously in digital literacy, ICT, computing or IT have not been considered pending the Royal Society *Computing in Schools* report. These should be considered in time.
- **Level 4 provision.**  
There will be students in a UTC environment that would benefit from working at Level 4 – for example on Level 4 vocational components of Higher Apprenticeships or aspects of HNC, first year Foundation or Bachelors degrees. These issues need to be assessed in the light of policies on Higher Education that are currently evolving.
- **Exemplifying the role of employers and Higher Education.**  
Employers and Higher Education staff and students offer much to UTCs in very many ways. Exemplifying this in case studies and advice notes would be helpful to emerging UTCs and other providers of technical education.
- **Work experience.**  
Providing students with work experience and experience of work is an important component of technical education. It can be provided in a variety of ways. Exemplifying this in best and future practice case studies and advice notes would be helpful to emerging UTCs and other providers of technical education.
- **A technical pedagogy.**  
New and alternative pedagogic practice will continue to emerge in UTCs. A guide to this would help orientate employers and others preparing to engage with UTCs and with wider technical education.
- **Guidance on funding.**  
Experience to date suggests that the standard formulas for assessing the scale and capital investment costs of equipping a school are not appropriate for UTCs and wider technical education. Variants are required.

## Annex A

### Economic returns to vocational qualifications

Data and analysis on the wage returns to vocational qualifications are given in:

Jenkins, A., Greenwood, C., and Vignoles, A., *The Returns to Qualifications in England: Updating the Evidence Base on Level 2 and Level 3 Vocational Qualifications*, Centre for the Economics of Education 2007. Key data are extracted and summarised here.

#### Returns to Highest Qualification Held

The Jenkins et al. model provides an estimate of the marginal return to a particular qualification for those for whom it is their highest vocational (or academic) qualification. The findings confirm previous evidence thus:

- Substantial positive marginal wage returns are found for many lower level (level 2) and intermediate (level 3) qualifications.
- However, NVQ2 qualifications do not provide individuals with positive marginal wage premiums, even for those who hold NVQ2 as their highest vocational qualification.
- Workers whose highest vocational qualification was an NVQ Level 2 suffered a wage penalty, i.e. these people earned a lower hourly wage than the base case of someone with no vocational qualifications at all.
- NVQ3 qualifications yield positive marginal returns for both men and women.

Many level 2 vocational qualifications offer substantial positive significant returns to individuals who hold them as their highest vocational qualification. For example, the return to a RSA qualification at level 2 for women is around 6%, whilst for men and women the return to BTEC at level 2 is between 4 and 5%.

At level 3, the return to NVQ for both men and women is positively significant (5-7%). The wage return is also positive and significant for other level 3 vocational qualifications, particularly BTEC (9% for men and 8% for women), City and

Guilts (10% for men only), ONC and OND (16% for men and 7% for women) and RSA (14% for women only).

#### Wage Returns to Level 2 Vocational Qualifications

Jenkins et al. present estimates of the return to level 2 vocational qualifications for workers who did not achieve level 2 at school. Quoting from sections of the document:

*“The average returns to level 2 vocational qualifications are lower than the marginal returns. The marginal return to most level 2 qualifications is positive and significant, particularly when the comparison group is made up of workers with no qualifications at all. This implies that level 2 vocational qualifications are particularly valuable, in terms of the wage returns they yield, for individuals who leave school with no qualifications at all or only low level academic qualifications”.*

*“The average return to NVQ2 remains nil even after choosing a more restrictive comparison sample, for both men and women”.*

*“Thus where NVQ2 qualifications are combined with other vocational qualifications their average economic value is low, even for low qualified individuals”.*

*“In some circumstances however, we observe positive significant average returns to NVQ2, such as for individuals working in skilled occupations. For males, even where NVQ2 is a person's highest vocational qualification, the marginal wage return is nil. The marginal return to NVQ2 for women*

**Note:** Average and Marginal Wage Returns to Level 2 and Level 3 Vocational Qualifications

The (estimated) average return to a qualification is the average economic value of that qualification across all individuals who hold that qualification. For some, the qualification will be their highest, for others it may only be one of many.

The (estimated) marginal return to a vocational qualification is defined here as the economic value of that qualification for individuals who hold that qualification as their highest vocational qualification.

is positively significant when compared to the earnings of low qualified (3%) and unqualified women (5%). The marginal wage return to NVQ2 for these restricted samples also varies by occupation and sector. For females we observe positive significant marginal returns in personal service (6%) and sales (3%) occupations and for males in skilled trades (8%), working as process/machine operatives (4%) and in elementary occupations (4%). For females with NVQ2 as their highest vocational qualification we observe a positive marginal wage return in the distribution (2%), public admin/education/health (4%) and other services (8%) sectors and for males in construction (11%)”.

### **Wage Returns to Level 3 Vocational Qualifications**

Jenkins et al. present estimates of the return to individuals who left school with only level 2 academic qualifications or below, and who do not have any vocational qualifications above level 3. Thus they consider the value of level 3 vocational qualifications for individuals who leave school, generally at age 16, with a good set of GCSEs at best and who do not go on to higher level vocational study. Quoting from sections of the document:

*“When one uses this restricted sample of those with level 3 vocational qualifications or below, the average wage return to holding a level 3 NVQ is just under 5% for women and 3% for men. Marginal wage returns to level 3 vocational qualifications are higher than average returns, i.e. the returns for those who hold a particular level 3 vocational qualification as their highest vocational qualification are higher than for all individuals holding that qualification”.*

*“The marginal wage return to NVQ3 in the restricted sample is 10% for females and 13% for males. However, some level 3 vocational qualifications yield much higher marginal wage returns for men and women, namely BTEC (16-17%) and ONC/OND (14-26%), and for women RSA (19%)”.*

*“Among men positive average and marginal wage returns are found for NVQ3 only in skilled occupations and for process and machine operative occupations. For women NVQ3 yields a positive marginal and average return for those in process/machine jobs, sales/customer, personal service and administrative/secretarial occupations”.*

*“NVQ3 also yields a positive marginal wage return across all sectors for the combined sample of men and women. However, closer examination reveals substantial variation in the marginal return by sector and by gender. Positive marginal wage returns to NVQ3 were found for women in the following sectors: energy and water (20%), manufacturing (16%), the hotel/restaurant sector (8%), transport (7%) public administration (10%), banking (5%) and other services (19%). For men there are significant and positive wage marginal returns to NVQ3 across all industrial sectors except banking. A very similar sectoral pattern was observed for average returns to NVQ3”.*

**Table 8: Cost-Benefit Analysis of Vocational Qualifications at Levels 2 and 3 in 2005/2005**

	IRR	NPV	NPV/DfES £
Advanced Modern Apprenticeship <sup>a</sup>	35%	£105,190	£17.12
Foundation Modern Apprenticeship <sup>b</sup>	39%	£73,001	£16.22
NVQ3 <sup>a</sup>	13%	£33,894	£11.55
NVQ2 <sup>b</sup>	9%	£13,012	£4.20
VRQ3 <sup>a</sup>	9%	£29,781	£3.29
VRQ2 <sup>b</sup>	7%	£8,049	£2.18

a = relative to Level 2      b = relative to Levels 1 and 2.

**Table 9: Cost-Benefit Analysis of Modern Apprenticeships by Sector 1996-2005**

	IRR	NPV	NPV/DfES £
Construction	30%	£156,523	£27.41
Engineering	15%	£78,351	£11.56
Hospitality	118%	£57,994	£14.78
Business Administration	18%	£56,765	£15.32
Retail and customer service	54%	£31,928	£8.80

**IRR** – Internal rate of return

**NPV** – Net Present Value (should be positive)

**NPV / DfES £** (NPV per pound sterling put in by the Government)

*All data extracted from:*

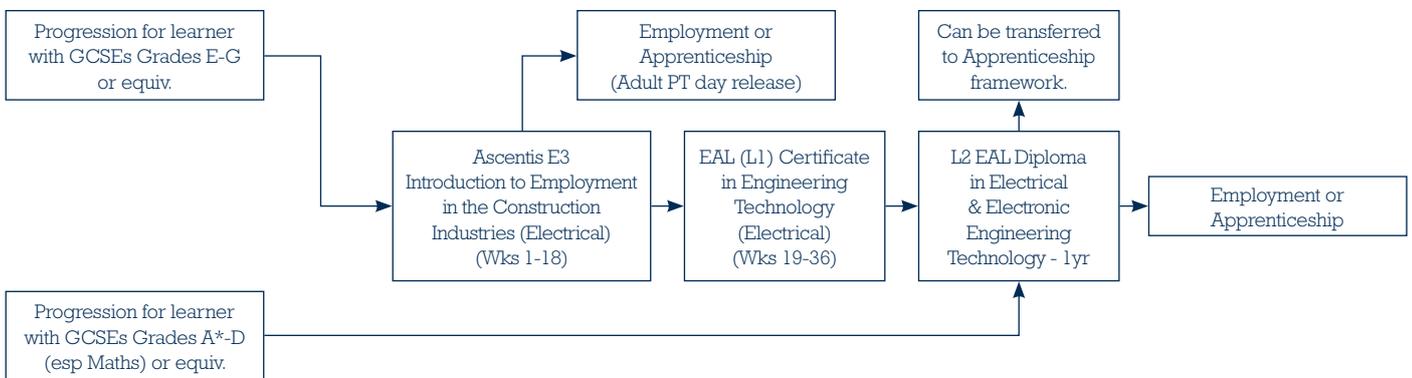
Jenkins, A., Greenwood, C., and Vignoles, A., The Returns to Qualifications in England: Updating the Evidence Base on Level 2 and Level 3 Vocational Qualifications Centre for the Economics of Education 2007

## Annex B

### Examples of feeder qualifications with option value

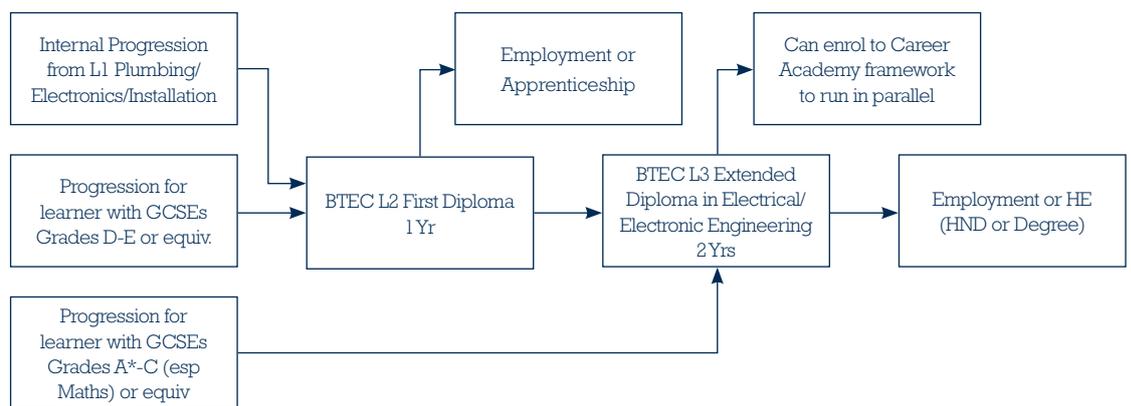
#### Progression chart - Electrical Installation 14-19

Provided by Neil Dickson (Lambeth College)



#### Progression chart - Engineering 14-19

Provided by Neil Dickson (Lambeth College)



## Annex C

### Exemplar distribution of guided learning hours (GLH)

The purpose of this Annex is to provide an indication of the guided learning hours that could be available for Technical studies in a typical UTC.

#### Example 1

##### Standard school days, standard number of teaching weeks

Total = 1,900 hours distributed over 2 years (25 hours teaching time per week over a 38 weeks period per year = 1,900 hours over a 2 year programme of study).

##### Technical (520 hours – in this example)

Technical Qualifications	410 Hours
Project (may not lead to a qualification)	60 Hours
Employment related subjects or skills	50 Hours

##### Core GCSEs (1120 hours – in this example)

Science	280 Hours
Maths	280 Hours
English	280 Hours
Language	140 Hours
Humanities	140 Hours

##### Other studies (260 hours – in this example)

PHSCE (may not lead to a qualification)	80 Hours
PE (may not lead to a qualification)	180 Hours

This example represents approximately 60% core GCSEs, 25% technical studies, 15% other studies. Other distributions could be employed. In addition, other distributions of core GCSEs could be favoured – for example increasing the time spent on Science by reducing the time spent on Humanities.

#### Example 2

##### The UTC: extended day, 2 additional teaching weeks per year

Total = 2,800 hours distributed over 2 years (35 hours teaching time per week over a 40 weeks period per year = 2,800 hours over a 2 year programme of study).

This provides an additional 900 hours over that in Example 1.

With for example 240 hours devoted to extra-curricular activities, there is room for (as illustration only) 140 GLH more on Science and a doubling of the Technical studies to 1040 GLH.

The significant impact of the extended hours proposed for UTCs is evident in these examples.

## Annex D

### UTC vision

#### Quoting from [www.utcolleges.org](http://www.utcolleges.org):

– **What is a UTC?**

A college for students aged 14 to 19 which specialises in technical studies and is sponsored by a university. It offers full time courses which combine practical and academic studies.

– It would allow a student to study a subject they are really interested in which is taught by teachers with real life practical experience and in industry standard facilities. By the time they are 16 they will be at least two years ahead of where they would be in a normal school.

– **How will a UTC improve job prospects?**

- Employers play a major part in University Technical Colleges. They help plan what students are going to learn and ensure that the qualifications students gain are what employers require. They also meet the students on work placements and so can get to know them.

– Students can either go onto to a high level apprenticeship in employment or onto a university. The college will help them decide which is the best route for them.

– **What qualifications will they offer?** - This will vary from College to College but all offer a combination of GCSEs in English, maths and science combined with practical and technical qualifications which are recognised by employers and universities.

– University Technical Colleges are a new concept in education. They offer 14-19 year olds the opportunity to take a highly regarded, full time, technically-oriented course of study. They are equipped to the highest standard, sponsored by a university and offer clear progression routes into higher education or further learning in work.

**“We want to forge a partnership between vocational education and universities, FE colleges and employers.”** Lord Baker

– The students combine hand and mind to learn in a very practical way, integrating national curriculum requirements with the technical and vocational elements. The college ethos and curriculum is heavily influenced by local and national employers who also provide support and work experience for students.

– University Technical Colleges specialise in subjects that require technical and modern equipment, for example, engineering, product design, health sciences, construction, and land and environmental services. However they all teach business skills and the use of ICT. The chosen specialism reflects the university's areas of excellence and the needs of local employers.

– A fundamental principle of University Technical Colleges is that they do not judge students on their past performance. Students are given new opportunities and new ways of learning which allow them to achieve to a higher level than they may have done before.

#### **Quoting from A UTC Curriculum Framework – 10th November 2010 (Baker-Dearing Educational Trust)” features of a UTC curriculum include:**

- A school day which runs from 8.30am to 5.30pm except for Mondays and
- Fridays when the finish would be 4.30 pm.
- A school year of 40 weeks and have either 4 or 5 terms.
- A comprehensive CPD policy which requires staff to remain up-to-date
- including experience of the employment sector.
- Every student has a mentor provided by local employers and/or the science
- and engineering ambassadors programme.
- Students will have completed any “homework” ( under supervision) by the
- end of the school day and not have work to do at home.

**For 14-16 year olds**

The core national curriculum requirements will be provided. The split of time between general education / bridging core studies and technical studies is 60:40 respectively.

**General education / bridging core studies:**

English; mathematics; science; a modern language; humanities ; sport/PE; PSHE (including personal and employability skills); RE; enrichment activities; Financial literacy; understanding and setting up a business; IT; and careers education and guidance.

**Technical studies:**

broad technical studies e.g. engineering; experience of work (10% of the total time for this component) ; projects( proposed by employers as far as possible); and mentoring.

The modern language would be the technical and general language associated with the technical study, enabling students to be technically competent in the language. For some students a GCSE course may also be followed.

The humanities will cover the history and geography of the development of the technical study, including major developments and the people responsible.

The mathematics and English studies, while aimed at GCSE will be supplemented by material that ensures basic numeracy and literacy are secure to the standard expected by employers. Much of this material will be taught as part of the technical studies, not separately.

The enrichment activities will include a range of experiences from further sport to community service to drama and art.

**For 16 to 19 year olds**

Post-16 students will be able to continue with their studies or they may choose to do an apprenticeship which might include part-time study at the UTC.

If students choose to continue full-time study at the UTC the split of time between general education/ bridging core studies and technical studies will become 40:60 respectively. The technical study will become more specialised and job-related and the content should not only lead to a technical qualification but also to a professional qualification such as "TechEng" or "TechSc", both of which are in the process of being developed and recognized by the professional bodies concerned. These will enhance employability and provide much needed skilled technicians.

**General education / bridging core studies:**

English; mathematics; science ; sport/PE; business understanding; IT; careers education and guidance; modern languages; short courses; employability skills.

**Technical studies:** Job specific content and professional qualification content; experience of work (equivalent of 1- day per week); projects (provided by employers) and mentoring.

The English work will centre on report writing and presentation skills, both oral and written (CV etc.).

The mathematics should support the requirements of the technical study as should the science. For many students these two subjects may well be studied to A-level or its equivalent, thus ensuring students have as many pathways open as possible. Short courses could include Level 4 units of study drawn from the sponsoring University or from the Open University.

The content of the technical studies should be determined by employers and higher education and also include any content needed to enable students to achieve the technician qualification.

The experience of work both pre and post sixteen is substantial and will have to be planned with the full support of employers. Between 14 and 16 all students will have at least 40 days experience of work increasing to 80 days between 16 and 18. The experience may be in blocks or shorter periods, in term time or in the holidays. It will all be related to the curriculum and assessed. It is recommended that all work place mentors are trained in order that the student receives a very high quality experience.

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The curriculum, whether at 14 to 16 or 16 to 19 must provide qualifications at Levels 1 - 2 (GCSE) and 3 (A-level or equivalent) thus providing real progression and no dead ends. It is essential that employers are consulted to ensure that they recognize and value the qualifications the students are studying for. Post-16 the apprenticeship option must also be offered.

The employability skills mentioned should be explicit but integrated into the Mainstream studies as appropriate. These include: team work; problem solving; customer service; oral presentation ; influencing (peers and seniors) self-management/time management; self-awareness/ self-reflection; global and cultural understanding; self motivation and importance of values.

Careers advice and guidance should also be explicit but integrated into the normal curriculum. Experience of work can make an important contribution to this. However much work will need to be done to provide high quality information and guidance for students. Current provision in schools falls well short of what is needed.

All courses will be available to GCSE, A-level or their equivalents as well as some at Level 1 . There will also be the professional qualifications available related to technician level. However it is possible that new courses and qualifications may need to be developed, particularly round the modern language and humanities studies, but whether every study unit should be separately qualified remains an open question.

One possibility is to develop a new "English Tech Bac" in which would sit existing separately qualified subjects while other studies could be assessed less formally. It is intended to investigate this and any new qualifications/courses needed over the coming period.

1. Register of Regulated Qualifications (RRQ)
2. A sufficient national community of practice is signalled by having more than 300 achievements nationally in a typical year with more than 20 centres offering the qualification.
3. Exemplar distribution of guided learning hours (GLH)

#### Technical (520 hours – in this example)

- Technical Qualifications (410 Hours)
- Project (may not lead to a qualification) (60 Hours)
- Employment related subjects or skills (50 Hours)

#### Core GCSEs (1120 hours – in this example)

- Science (280 Hours)
- Maths (280 Hours)
- English (280 Hours)
- Language (140 Hours)
- Humanities (140 Hours)

#### Other studies (260 hours – in this example)

- PHSE (may not lead to a qualification) (80 Hours)
- PE (may not lead to a qualification) (180 Hours)

**Total = 1,900 hours distributed over 2 years (25 hours teaching time per week over a 38 weeks period per year = 1,900 hours over a 2 year programme of study.\***

## Annex E

### Technical qualifications selected for use in University Technical Colleges

#### Template to aid the qualification selection process

Qualification: \_\_\_\_\_

Level: 2

Scoring: 0 / Clear No / 1 / Yes with reservations / 2 / Clear Yes

#### Stage 1: Indicators of respect in the STEM community

Selection criteria	Score independent of local context	Local contextualised effect	Final score
Progression to further STEM study			
Progression to STEM-based apprenticeship			
Economic return			
Practical content			

#### Stage 2: High level criteria

Selection criteria	Score independent of local context	Local contextualised effect	Final score
Must be funded and legal for 14-19			
S, T, E or M (or related)			
Mathematics not numeracy			
Publicly funded for under 16s (RRQ) <sup>1</sup>			
Appropriate level			
National community of practice <sup>2</sup>			
Fits required GLH <sup>3</sup>			

\*This example represents approximately 60% core GCSEs, 25% technical studies, 15% other studies. Other distributions could be employed. In addition, other distributions of core GCSEs could be favoured – for example increasing the time spent on Science by reducing the time spent on Humanities.

Using extended teaching days and 2 additional teaching weeks per year 2,800 hours is available distributed over 2 years (35 hours teaching time per week over a 40 weeks period per year = 2,800 hours over a 2 year programme of study. This provides an additional 900 hours. With for example 240 hours devoted to extra-curricular activities, there is room for (as illustration only) 140 GLH more on Science and a doubling of the Technical studies to 1040 GLH.

**Stage 3: Detailed criteria applied to qualification specifications and other documentation**

Selection criteria	Score independent of local context	Local contextualised effect	Final score
Ethos <sup>4</sup>			
Validity <sup>5</sup>			
Pedagogy <sup>6</sup>			
Assessment <sup>7</sup>			

**4. Ethos**

- Must fit with the UTC vision: evidenced by meeting the criteria in Annex D
- Must distinguish between paper qualifications and real skills: evidenced by assessment criteria that add weight to the acquisition of STEM knowledge, STEM skills, practical / technical skills, problem solving skills, analytical skills.
- Must accommodate a 'practical identity' as well as a 'technical identity': evidenced by content that prioritises practical / technical content.
- Must encourage creativity / ingenuity ('designerly behaviour'): evidenced by assessment criteria that accommodate ambiguity and require solving of more open-ended problems.
- Must encourage experience-led approaches: evidenced by employer engagement in qualification design and development.
- Must encourage co-development by employers and HE.

**5. Validity**

- Preferably endorsed by professions: evidenced by approval by organisations licensed to assess applicants for professional registration (for example the Professional Engineering Institutions: IET, IMechE, ICE etc.)
- At Level 2, must provide credible progression opportunities when taken alongside core GCSEs in academic subjects: evidenced by research into apprenticeship framework requirements, entry requirements for Level 3 study. This includes careful consideration of which optional units are taken.
- At Level 3, must provide credible progression opportunities when taken alongside core GCSEs in academic subjects: evidenced by UCAS tariff points, higher apprenticeship framework requirements, wage returns evidence. This includes careful consideration of which optional units are taken.
- Must include a significant transferable (portable) knowledge core: evidenced by significant STEM content in key content and learning outcomes. Cannot therefore be solely based on National Occupational Standards.
- Must be future-proof: evidenced by the content which should include material which deals with societal, economic and technological trends.

**6. Pedagogy**

- Must encourage activities that are real 'projects' and not solely closed-ended training exercises: evidenced in sample assessment materials.
- Must have a structure that encourages independent learning: evidenced by appropriate assessment methods.

**7. Assessment**

- Must be rigorous: evidenced by the use of a mix of assessment methods: both external and internal. Outcomes should include knowledge outcomes, practical outcomes, and applied outcomes.
- The application of practical / technical skills should be assessed: evidenced by appropriate weighting in the assessment criteria.
- Assessment methodology should not be excessively bureaucratic.
- Contextual assessment (the application of subject knowledge to the solving of real problems) should be sought wherever practicable. The assessment practice emerging around the Higher / Extended Project Qualification may prove useful.

**Stage 4: Combinations and restrictions**

Selection criteria	Score independent of local context	Local contextualised effect	Final score
For Level 2 learners (considering likelihood of attainment in GCSEs taken alongside			
For Level 1 learners			

**Stage 5: Gap analysis**

Selection criteria	Score independent of local context	Local contextualised effect	Final score
Are there alternatives available nationally or locally?			

**Stage 6: The community view**

Selection criteria	Score independent of local context	Local contextualised effect	Final score
Respected by employers			
Respected by FE Colleges			
Respected by HE			
Practitioners' views	Score independent of local context	Local contextualised effect	Final score
Availability of specialist teachers			
Availability of technical support			
Equipment needs			
Space needs			
Timetabling issues			
Access to authentic environments			

## Annex F

### Level 2 qualifications that were discounted

Qualifications with sufficient communities of practice that were considered for inclusion on the list but discounted are shown below. These include:

- All NVQs for the reasons set out in Stage 4
- All ICT, computing and IT related qualifications (including the 14-19 Diploma) pending the outcome of the Royal Society Computing in Schools study.

- Qualifications explicitly designed for practitioners or users in the workplace
- Qualifications that are in S,T,E,M but do not fit the UTC vision (non-technical STEM qualifications such as those in animal care)

In addition a larger number of qualifications with less than 300 annual attainments in the FE & Skills sector in England were discounted.

OCR National Certificate / Diploma in ICT	OCR				Pending Royal Soc. study
<b>NVQ in Performing Engineering Operations</b>	EMTA	C&G	EDEXCEL	PAAVQSET	NVQ not listed for UTC
<b>NVQ in Vehicle Maintenance and Repair</b>	C&G	IMIAL			NVQ not listed for UTC
<b>NVQ in Mechanical Engineering Services – Plumbing</b>	C&G	EMTA			NVQ not listed for UTC
<b>NVQ in Railway Engineering</b>	C&G				NVQ not listed for UTC
<b>NVQ in Mechanical Engineering Services - Heating and Ventilating Installation</b>	C&G	EMTA			NVQ not listed for UTC
<b>NVQ for IT practitioners</b>	C&G	EDEXCEL			NVQ not listed for UTC
BTEC First Diploma for ICT Practitioners	EDEXCEL				No (for practitioners)
BTEC First Certificate for ICT Practitioners	EDEXCEL				No (for practitioners)
Diploma for IT Practitioners	C&G	OCR			No (for practitioners)
BTEC First Diploma in Animal Care	EDEXCEL				NO (not UTC vision)
Certificate in Environmental Sustainability	ASCENTIS				NO (only 10GLH)
National Certificate in Animal Care	NPTC				NO (not UTC vision)
BTEC First Certificate in Animal Care	EDEXCEL				NO (not UTC vision)
Certificate in Interactive Media	NCFE				NO (not UTC vision)
BTEC Award in Interactive Use of Media	EDEXCEL				NO (not UTC vision)
Certificate in Electrotechnical Technology	C&G				NO (STEM<20%)
Certificate in Basic Plumbing Studies	C&G				NO (not UTC vision)
Construction Award	CSKILLS				NO (no pre 16)
<b>Certificate in Heating and Ventilation Installation</b>	C&G				NO (not UTC vision)
<b>Certificate in Domestic Natural Gas Installation and Maintenance</b>	C&G				NO (not UTC vision)
Award in Welding Skills (QCF)	C&G				NO (not UTC vision)
BTEC First Diploma in Horticulture	EDEXCEL				NO (<20% STEM and only optional)
BTEC First Diploma in Countryside and Environment	EDEXCEL				NO (<20% STEM and only optional)

– **Bold** denotes approved for use in at least one apprenticeship framework

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## **Annex G**

### **Level 3 qualifications that were discounted**

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Qualifications considered for the Level 3 list but discounted:

- BTEC National Certificate / Diploma for IT Practitioners (a qualification designed for those with prior working experience)
- City & Guilds Advanced Diploma for IT Professionals (a qualification designed for those with prior working experience)
- All NVQs for the reasons explained in Stage 4
- BTEC National Certificate / Diploma in Music Technology (does not fit UTC vision)

In addition a larger number of qualifications with less than 300 annual attainments in the FE & Skills sector in England were discounted.

## Participants

### Project lead

Professor Matthew Harrison  
 Director, education  
 The Royal Academy of Engineering  
**Contact:** matthew.harrison@raeng.org.uk

### Panel of school leaders:

Liz Allen (Newstead Wood School, Bromley), Jim Wade (JCB Academy, Staffordshire), Lee Kilgour (Aston University Engineering Academy, Birmingham), Alan Yates (Great Sankey High School, Warrington), Chris Hoyle (Ridgewood School, Doncaster), Jan Renou (Skipton Girls' High School, North Yorkshire), Rob Robson (Samuel Whitbread Community College, Bedfordshire)

### Convener

Les Jones Chief Executive Solutions 4 Schools/The Engineering Company (Europe) Ltd

### Advisory Group:

The Advisory Group was drawn principally from the National Committee for 14-19 Engineering Education which is convened by The Royal Academy of Engineering

Matthew Harrison (RAEng); Styli Charalampous (RAEng), Dominic Nolan (RAEng), Hal Igarashi (RAEng), Rhys Morgan (RAEng), Alan Bellamy (Construction Skills), John Williams (Gatsby Charitable Foundation), Ruth Wright (Engineering Council), Marion Thom (Jaguar Land Rover), Peter Catton (City of Bristol College), Charles Tracey (Institute of Physics), Stephen Price (National Apprenticeship Service), Deborah Ribchester (Association of Colleges), Martin Hollins (self), Chris Kirby (IMEchE), Tony Hicks (EU Skills), David Barlex (DATA), Catherine Elliott (SummitSkills), Helen Roberts (National Science Learning Centre), Kirsten Bodley (STEMNET), Graham Lane (self), Barry Lewis (STEMNET), Les Mustoe (IMA), Gareth James (IET), Hugo Donaldson (IET), Ian Moores (Cogent), Caroline Sudworth (Cogent), Richard Green (DATA), Daniel Sandford-Smith (Gatsby Charitable Foundation), Ruth Sorsby (SSAT), Martin Bevan (SMC Training), Alison Halstead (Aston University), Bryan Williams (self), Richard Earp (National Grid), Fred Maillardet (EPC), Gareth Humphreys (MBDA), Malcolm Carr West (Engineering Subject Centre), Gary Drabble (Sheffield City Council / Rotherham MBC), Rob Best (LSBU), Liz Addison (e-skills), Richard Browne (MEI), Peter Mitchell (Baker-Dearing Trust), Jane Ware (Baker-Dearing Trust), Paul Pritchard (JCB Academy), Robert Lovelock (North Hertfordshire College), Martin Stevens (A1 Technology), Andrew Barker (Bath & North East Somerset Council), Richard Jarrald (City College Norwich)

### Convener

Matthew Harrison (RAEng)

For more information  
or to discuss the  
'Respected' document  
please contact:

**Edge**  
4 Millbank  
London  
SW1P 3JA

**Telephone**  
020 7960 1540

**Fax**  
020 7960 1557

**Email**  
[centre@edge.co.uk](mailto:centre@edge.co.uk)