TECH PARTNERSHIP
skills for the digital economy

Department for Digital, Culture, Media & Sport

LANGUAGE MATTERS

HELPING STUDENTS, EDUCATORS AND EMPLOYERS DEVELOP A COMMON UNDERSTANDING

COMMISSIONED BY THE UK GOVERNMENT DEPARTMENT FOR DIGITAL, CULTURE, MEDIA AND SPORT (DCMS)

Contents

All corrections and improvements to this publication will be gratefully received.

Please send any input to **info@thetechpartnership.com**.

Foreword

This government and I are absolutely clear in our aim that the UK should be the best country in the world to start and grow a digital business, and to innovate with technology. We want digital entrepreneurs to think of the UK first when considering setting up their companies and testing their ideas.

For the UK to be a world-leading digital economy that works for everyone, it is crucial that everyone has the digital skills they need to fully participate in society – from the basic digital skills people need to make the most of living fulfilling lives to the general digital skills increasingly needed in every job in almost every sector.

We also require the advanced digital skills for the growing number of specialist digital roles across the economy. There were 2.2 million jobs in the Digital Economy in 2016 – an increase of 2.7% on the previous year.

So we should all be concerned that computer science graduates have the highest level of post-graduation unemployment rates of all graduates. With high demand for specialist digital skills we must wonder why this is the case. Professor Sir Nigel Shadbolt's Review set out a number of reasons to answer this. One contributing factor highlighted was the difficulties in communicating skills needs between industry and academia, and the importance of better bridging these two worlds. Without an improved understanding or common language it is also difficult to articulate well the varied and rewarding digital career opportunities available in ways that school pupils and graduates fully understand.

I am, therefore, delighted to provide my support for this Guide which the Department for Digital, Culture, Media and Sport commissioned to improve the communication between students, employers and educators. I am confident that, if it is widely used and evolves in line with changing technology, we will see employers' skills requirements, students' career aspirations and education and training offers will be better matched and fulfilled.

Margot James
Minister for the Digital and Creative Industries

Foreword

Employers across all industries are struggling to meet their needs for digital skills. 52% of UK businesses in the digital industry report 'hard to fill' vacancies[1], and this in an environment where, each year, 138,000 new people a year are needed to enter the digital specialist workforce[2].

Set against this, computer science has the highest level of unemployment of any subject grouping at degree level six months after graduation, at around 10%, and employers are largely missing out on half the UK talent, with only 17% of digital specialists and 16% of computing degree undergraduates being female[3].

Our work with employers, academics and students tells us that the lack of a common language is contributing to these issues. The fast-moving nature of the digital world means that language is changing all the time. The terms of the job market and those of academia can appear removed from each other, and both can be opaque to students. Adding to this complexity, people can use the same term to mean different things and different terms to mean the same thing.

This document aims to improve the understanding of language used in IT-related education and employment, based on a quantitative analysis of over 100,000 job adverts for digital specialists and nearly 3,000 titles of IT-related degrees, along with detailed input from over 100 senior professionals across education and industry.

Technology is an exciting, dynamic sector to work in. We hope this publication will help educators, employers and students to understand each other better, help universities and industry to more easily explain the relationship between degree courses and digital employment, and, as a result, improve the flow of talent into our workplaces.

Karen Price OBE
Chief Executive, The Tech Partnership

1 Factsheet: Demand for Digital Specialists – the Tech Partnership, July 2016.
2 Factsheet: Tech Specialists, the Tech Partnership, February 2016.
3 The Tech Partnership 2017 and Higher Education Statistics Agency 2017 – see Annex A for definitions.

1. INTRODUCTION

1.1 About Language Matters

This publication has been created to help improve the understanding of language used in IT-related education and employment, with the goal of increasing the flow of talent into digital careers.

This report provides an analysis and evaluation of the language of technology and how terminology and meaning can differ between the worlds of education and industry.

Methods of analysis include desk research, workshop presentations, qualitative research across industry and education, keyword term evaluation and in-depth one-to-one interviews.

The report shows that while there is clear recognition from all participants that there is a need to build connectivity between education and industry through language, there is considerable scope for improvement.

Recommendations discussed include:

- Students learning through employers and alumni about the lexicon of industry ahead of graduation and taking an active interest in the wider range of roles beyond programming that a career in IT increasingly offers.
- Employers not trying to seek too many highly specific requirements from undergraduates in their recruitment advertising, focusing more on the skills and behaviours they seek for specific roles and outlining the type of work recruited individuals will be doing once trained and established.
- For educators to use technology to ensure they can engage with employers more, despite their mutually busy lives, and to encourage soft skills behaviours through the programmes they teach, since these are the skills that make a real difference for the employability level of tech graduates today.

The report also acknowledges that the analysis conducted has limitations – for instance, given time more detailed analysis could be done of not just undergraduate course titles, but the language used on websites and in prospectuses.

1.2 Audiences

Language Matters has been created to be as user-friendly as possible, whether you are an apprentice thinking about a first role in technology, a degree student evaluating your skills fit with current opportunities in the tech sector, a higher education institution considering how best to build bridges with local industry or an employer, looking to secure the best possible talent to grow your business.

Throughout the document, there are useful insights and signposts to help you think about some of the important considerations that will help to reduce language barriers in the transition between education and employment. If you would like more detail, you'll also find further reference materials and detailed research outputs in the Annexes to the document:

- **To see a comparison of popular terms** used in IT-related job advertisements and Higher Education course titles, please turn to **page 30**, **Annex B**.
- **If you are a you're a young person** wanting to know more about the most popular terms you might come across in the workplace, then review our dictionary of key terms in **Annex C** on **page 33.**
- **If you are applying for a job**, or **if you are an employer** thinking about recruiting, the table of occupational areas and common entry-level job titles in **Annex D** should be of interest.

Finally, throughout the document, there are in-depth interviews with experts from large companies, small businesses and education, collectively offering insights into how technology is changing and the implications for people applying for their first position in a sector which is growing and innovating at an extraordinary rate.

- For key findings for students, please turn to **Page 22**
- For key findings for employers, please turn to **Page 23**
- For key findings for educators, please turn to **Page 24**

1.3 Background

This publication was commissioned by the Department for Digital, Culture, Media and Sport in follow up to the Shadbolt Review of computer science degree accreditation and graduate employability of May 2016, which recommended exploring the possibility of establishing a common language between education and industry, to improve employability at entry-level positions.

Underpinning it is extensive desk research and a quantitative analysis of job adverts for digital specialist roles and of the titles of IT-related degree courses. This is supplemented by detailed qualitative input from 100 senior professionals from industry and academia through a series of roundtables and in-depth interviews.

The following chapters summarise the findings from the research, offer insights from employers and academics, provide explanations of some of the most common terms in relation to entry level digital employment, and conclude with reflections on what was learned from the work.

Language is constantly evolving, especially in such a fast-moving sphere, and all corrections and improvements to this document will be gratefully received at **info@thetechpartnership.com**.

2. JOB ADVERTISEMENTS AND COURSE TITLES

2.1 Research approach

The analysis in this chapter considers terminology a student may typically encounter when searching for IT-related education or employment. It considers the prevalence of popular words in:

(a) 101,869 advertisements for digital specialist jobs in the last quarter (Innovantage, quarter 3 2017); and

(b) 2,925 course titles of IT-related undergraduate degrees in the last academic year (Higher Education Statistics Agency, 2017)[2].

The following three tables consider the ten most popular words used in job adverts and degree titles. The tables show their prevalence and the variance between their use in job adverts and degree titles.

To see the full analysis of key words in each sector, including the least popular terms, please refer to **Annex B** at the rear of this document, which extends these tables to 37 common words, showing the most to the least popular in each context.

Three views provided:

Table 1 orders the words by prevalence in job adverts.

Job adverts				
40%+	30-39%	20-29%	10-19%	0-9%

Table 2 orders the words by prevalence in degree course titles.

Degree titles				
40%+	30-39%	20-29%	10-19%	0-9%

Table 3 orders the words by variance between the two.

Variance				
40%+	30-39%	20-29%	10-19%	0-9%

Bolding highlights in a category shows the term is more popular (i.e. in job adverts or in degree titles).

Additional analysis could be undertaken by considering prevalence in degree course descriptions, but this was not in scope of the current work.

2 See Annex A for definitions.

2.2 Use of terms in digital specialist job adverts

Table 1 below shows that, of the popular terms analysed, the most commonly used in digital specialist job adverts are 'development' (60% of adverts), 'support' (59%), 'business' (56%) and 'management' (47%).

These four terms also present the biggest variance when comparing prevalence in job adverts and prevalence in IT-related degree titles, with all having a variance of 40% or more. Only 3.5% of the degree titles use the word 'development', none use 'support', 9% use 'business' and 7% use 'management'.

The next five most popular of the terms in job adverts were 'software', 'systems', 'technology' and 'software development', and these also showed significant variance when compared with degree title, all being over 30%.

Note: To further illuminate use of language in industry, Annex C provides a reference table of typical occupational areas, job functions, job titles and skills sought by employers, based on frequently occurring job titles used in graduate-level recruitment.

Table 1: Popular terms, ordered by prevalence in digital specialist job adverts

Prevalence of common terms	Job adverts	Degree titles	Variance
Development	**60.1%**	3.5%	56.5%
Support	**58.7%**	0.0%	58.7%
Business	**56.3%**	8.7%	47.5%
Management	**47.1%**	6.9%	40.2%
Software	**45.4%**	7.2%	38.2%
Systems	**44.6%**	12.8%	31.8%
Technology	**40.5%**	9.5%	31.0%
Software Development	**37.3%**	1.0%	36.3%
Data	**34.4%**	2.8%	31.6%
Information	**31.7%**	13.8%	18.0%

How could students and apprentices use this information?

- Learn more about the most popular terms in industry, cross-referencing them to the definitions provided in Annex B. Think about how what you are learning relates to what employers are asking for.
- Look at as many job adverts as you can. These will be clear trends in the sector that you should try and stay abreast of for any interview process – showing an interest in the wider sector beyond what you have been taught is very attractive to employers.

2.3 Use of terms in IT-related degree course titles

Table 2 below shows that, of the popular terms analysed, the most commonly used in IT-related undergraduate degree titles are 'computer' (37%), 'science' (31%), 'computing' (29%) and 'computer science' (20%).

Notably, these are also the only ones which are more prevalent in degree titles than in job adverts.

Table 2: Popular terms, ordered by prevalence in IT-related degree titles

Prevalence of common terms	Degree titles	Job adverts	Variance
Computer	**37.1%**	16.3%	20.8%
Science	**30.8%**	13.7%	17.1%
Computing	**29.3%**	5.5%	23.9%
Computer Science	**19.8%**	10.2%	9.7%
Information	13.8%	**31.7%**	18.0%
Systems	12.8%	**44.6%**	31.8%
Technology	9.5%	**40.5%**	31.0%
Business	8.7%	**56.3%**	47.5%
Engineer	8.2%	**25.0%**	16.8%
Engineering	8.0%	**19.7%**	11.8%

How could Higher Education institutions use this information?

- There is a clear difference between the well-established language of academia for degree programme titles – in particular "Computer Science" and "Computing" – and the language of industry, which rarely uses these terms in job adverts, with only 10% and 5% of usage in IT-related job adverts respectively.

  Yet the skills developed may be highly relevant to industry needs, with 60% of job adverts referring to "development" and 45% to "software". Universities might find it helpful to use terms more popular in industry moving forward to better signpost the link between courses and careers.

- Soft skills are increasingly important to employers looking for talent that is not only technically gifted but who can engage with new and existing clients, manage complex projects and translate business needs into workable technology solutions.

  Degree programmes could articulate more visibly how these skills are developed, and explain why they are increasingly important as core components of any teaching curriculum. With 80% of IT job roles requesting team work skills for example, it would be valuable to build team-working environments into degree programmes as much as possible.

2.4 Variance between use of terms in job adverts and degree titles

Table 3 below orders the terms by the variance in prevalence.

Prevalence of popular terms in digital specialist job adverts and IT-related degree titles, ordered by extent of variance

Prevalence of common terms	Variance	Job adverts	Degree titles
Support	58.7%	**58.7%**	0.0%
Development	56.5%	**60.1%**	3.5%
Business	47.5%	**56.3%**	8.7%
Management	40.2%	**47.1%**	6.9%
Software	38.2%	**45.4%**	7.2%
Software Development	36.3%	**37.3%**	1.0%
Systems	31.8%	**44.6%**	12.8%
Data	31.6%	**34.4%**	2.8%
Technology	31.0%	**40.5%**	9.5%
Project	26.4%	**26.7%**	0.3%

How can employers use this information?

- The data provides clear guidance on popular terms, which students may then use when searching for positions via search engines. It makes sense therefore to use this information to inform the key words used in job advertisements where possible.

  While everyone wants to stand out, it makes more sense to be more creative with your copywriting when promoting your brand and what it stands for, not by using too much jargon in the title or job description of any role you are advertising.

INSIGHT

Reflections on differences in language

While there is a disconnect between the language in degrees and entry-level roles, this is as much industry's responsibility as education. Previously at Fujitsu we used too much jargon in our job descriptions, seeking "Customer Solutions Architects", which bewildered applicants. We now use simple, instructive language for roles, such as "Business Management – Graduate level" to explain the role and that it is a graduate level position. While sometimes it would be nice to advertise for a specific role, like a Scrum Master Graduate, the good outweighs the occasional limitation, and we don't want to deter good applicants from applying, whatever their background. Since taking this approach, and checking the language we use through a Harvard Business School tool we've acquired to screen out any gender bias or excessive jargon, we've seen applications increase by 3,000%!

We recognise universities teach a broad range of skills within degrees, but with Computer Science degrees it would undoubtedly be more helpful if we had more clarity around areas of specialism that have been taught, to establish whether the graduate's knowledge is at the time of application more theoretical or more contemporary, and where their specialism lies. This information is useful when a candidate who has passed the first stage of application has their technical interview.

Unusually we don't have a CV screening phase for graduate candidates at Fujitsu. Instead we have an online situational judgement test that candidates take. The scenario, questions and best answers all come from evolving data from the most successful candidates who have taken the test across the last five years. We've found this to be a much more effective way of identifying candidates with the skills, behaviours and communication skills that fit with Fujitsu's culture, and we've seen much higher pass rates in the later stages of application from candidates passing the screening.

Mark Jackson
Junior Talent Acquisition, Fujitsu UK and Ireland

FUJITSU

3. VIEWS FROM ACADEMIA AND INDUSTRY

3.1 Research approach

Having established the extent to which students are presented with differing language when considering digital specialist job adverts and degree course titles, direct input was sought from leading employers and academics through a detailed qualitative research questionnaire.

A series of in depth interviews was also conducted to explore consultees' experience of preparing and recruiting students from degrees and/or into degree apprenticeships.

Much valuable input was received which helps to illuminate the use of language in IT-related education and employment. This chapter highlights common themes emerging from this qualitative research. More detailed extracts, including lessons learned, are used throughout this publication.

3.2 What's in a name...

Many people offered views on the uses, benefits and limitations of the broadest of terms relating to this sphere, notably IT, Technology, Digital, Computing and Computer Science. Typical comments included the following, which emphasise the increasing move towards 'digital':

> ***"'IT' has a boring/nerdy image, 'technology' too vague, 'digital' is a fashionable but confused term, 'computing' is a research-based academic discipline."*** *(Employer)*

> ***"We have started to use 'digital', 'data' and 'technology' in all our adverts."*** *(Employer)*

> ***"Digital is gaining broad adoption but in so many contexts that it does not provide specification. Digital marketing is very different to digital networking."*** *(Employer)*

> ***"I'd prefer everything under the banner of Technology and from there you have specialisms – e.g. Cyber, IT systems, Software Programming."*** *(Employer)*

A number of consultees highlighted concerns that 'Computing' or 'Computer Science' in degree titles may appear too restrictive, for example:

> ***"Computer Science degrees sound very tech-heavy with traditional software development and not much on how to apply it to the business world – it's a specific academic endeavour with increasingly less mass applicability."*** *(Employer)*

> ***"I've met many students who think because they are studying a Computer Science degree the only career open is a programmer."*** *(Educator)*

INSIGHT

Increasing the number of high quality job applications

We tailor our language depending on the type of application. We've discovered that with degree apprenticeships, candidates are less likely to understand some of the theory and technical terminology that graduates learn – so we focus on case studies, community support networks and what apprentices will gain from the programme, knowing we can accelerate their technical knowledge through being in the working environment throughout their studies.

With graduates too, the pace of change in industry is so quick and relentless that some of the titles we used to use for job roles, which are still frequently used in higher education – for example, 'software engineer' – no longer reflects the range of work our technology graduates do. We have a breadth of roles, some more technical than others, but what unifies all our roles is the expectation that our people will be client-facing and have the necessary soft skills to work with our business partners. We've now softened the technical language within our graduate advertisements and removed the requirement for technical degrees, which has increased applicant levels dramatically, without any deterioration in the quality of application.

We're acutely aware of the importance of a diverse workforce too, so all our adverts are analysed through a language tool to ensure our recruitment uses inclusive, neutral language. Moving from using narrow job descriptions like 'software engineer' to promoting careers in technology more broadly has transformed the level of female applicants to roles in technology for Accenture.

A crucial part of our recruitment process is a technical interview, where we expect graduates to demonstrate their communication, teamwork and problem-solving skills, as well as their passion for IT. Importantly we're as interested in their curiosity for exploring and using recent technology in any form, as we are their academic capability in Computer Science. We recognise that the pace of change is faster in technology than in any other industry, and this can cause confusion around how language is used or adapted when moving between education and industry, which is why we now seek graduates with the most transferable workplace skills more than simply the most IT-literate applicants.

Damian Corneal, Apprenticeship Programme Lead,
Diahann Abraham, Apprenticeship Recruitment Lead &
Brian Ahern, Training Lead Accenture Technology

accenture

3.3 Breadth of skills

Many employers and academics commented on the need, in today's business environment, for additional skills that are broader than the technical.

> ***"I'm not looking for programmers, but people who can apply technology in a business environment."*** *(Employer)*

> ***"Given the rise of programming in schools, it's important to explain the industry is wider than programming – especially the importance of soft skills."*** *(Educator)*

Some employers expanded on how job roles are changing in the light of changing demand from clients, and the need for new recruits to have excellent client-facing business and interpersonal skills as well as appropriate technical knowledge. Some employers felt that it can be easier to teach the latter, and prioritise seeking out applicants with the client-facing skills they need.

INSIGHT

Skills Evolution in Tech

Our challenge is slightly different to many organisations, in as much as we are perceived as a company that you need to have a computer science background to work for, yet one of our goals today is to make non-technical graduates also aware that there are exciting career possibilities with IBM, and you don't necessarily need to have a computer science degree to be accepted by us.

The technology we are working with today, such as artificial intelligence, cognitive systems and machine learning, is taught in a limited number of undergraduate programmes, as the pace of change is too great to be reflected in any academic syllabus. So we use case studies to show the possibilities of where your career might take you and the growing diversity of our recruitment base. Many non-tech graduates still believe we're in the business of making PCs and servers, so we look to excite their curiosity – candidates wouldn't expect to be for instance using cognitive learning to identify the best breed for a guide dog, a current project some of our graduates are working on.

We seek to identify potential candidates in several ways. We spend a considerable amount of time on campuses engaging with students, and now have on-site labs in Manchester and York as part of strategic partnerships, where we can demonstrate our latest work across the university. This is a useful way for us to build an understanding of the lexicon of industry too. We also pose interesting problems and challenges on social media, encouraging people who can solve these puzzles to think about the possibilities of a career in tech.

Candidates then apply for a "bucket role" across business, consulting, technology or design. Generally, any graduate disciplines will be considered, though there are some roles, such as Strategic Analytics Consultant, where we require analytics knowledge and use in advance. Candidates attend an assessment centre, after which they are placed in a matching pool from which a hiring manager can appoint. Soft skills are tested throughout the process, and we use video interviews to ensure candidates can present themselves as suitable ambassadors for IBM in the future.

There is a 2-3 year foundational programme, where we ensure our graduates have all the skills required. What we usually find is that some graduates will need perhaps more support in developing non-technical skills, whereas other graduates might be better equipped on soft skills, but need more time to develop coding skills. We expect all our graduates in time to be able to have both capabilities – increasingly our clients want a consultant in their offices who can not only problem solve, present and lead, but who can code on site immediately if required, rather than having to refer it back to a central function.

In 2018, we launch our first Degree Apprenticeships too. I don't believe this will impact on graduate recruitment levels, it's a slightly different skill set we are seeking for these very specific roles – but it will certainly add workplace maturity and impact as apprentices will be learning while using the latest technology and absorbing the language of industry and education simultaneously.

Oli Jacob
IBM UK Early Professional Engagement & Attraction Lead

INSIGHT

Learning from experience

We have previously struggled with getting the right graduates to apply for the most appropriate roles, so at Tata Consultancy Services we decided to create four distinct role profiles across our work in technology.

For three of the roles – Software Engineer, Test Engineer and Network Engineer – we do specify that we are looking for graduates with a degree in IT, computer science or a technology-related subject, whereas for our Business Analyst role there is no technical degree prerequisite, we want graduates from any discipline who are passionate about technology, creative problem solvers and forward thinkers.

Making this distinction more apparent has greatly improved the relevance and quality of our application intake.

Yogesh Chauhan
Director of Corporate Sustainability, Tata Consultancy Services

TATA CONSULTANCY SERVICES

Alongside this, several consultees commented on the fact that students can be put off by adverts asking for specific skills they may not have:

> ***"A lot of students are scared off if they see a technical skill stated on a job description that they don't have and they don't apply because of this. They often don't appreciate the fundamentals that they have learned at university should enable them to pick up new technologies quickly and they don't need everything to do a job well."*** ***(Employer)***

INSIGHT

The need for breadth of skills

The two big challenges I see for Computer Science graduates are:

Firstly, at the end of a 3-year degree, you have studied a course and tech that was designed/relevant 3 years ago – at best. We all know how quickly tech moves in the commercial world. Universities are teaching waterfall development cycles, whist the corporates have moved on to agile and continuous deployment. It's hard for universities to know what tech/skills will still be relevant in 3-5 years.

Secondly, Computer Science has become a mainstream degree... Basic coding is now also taught in schools, and programming can also be self-taught – some of the best developers I know don't have a degree at all, let alone a Computer Science one... This means Computer Science graduates need to do more to stand out to land their first job, pure theoretical knowledge of computing is no longer sufficient to attract the best recruiters, they are looking for someone with broader, more marketable skills too.

Lee Harding
IT, Digital & Retail Talent Acquisition Partner, Shop Direct

3.4 Gender differences

A number of consultees went on to reflect on their experience that women can appear less likely than men to apply for job roles for which they do not have all the skills requested. This is an important point to note given the magnitude of the gender imbalance in digital employment.

> ***"A lot of female graduates are put off from applying for a role that has very specific requirements if they don't meet ALL of them. We are more interested in general, transferable skills and hire from any graduate discipline."*** ***(Employer)***

The importance of understanding typical female and male reactions to different language was raised by both employers and academia. An American study analysed 4000 student's reactions to job descriptions, which showed that, for females:

- **The most attractive words were: flexible, develop, skills, opportunity, exciting, work, challenging, training**
- **The most unattractive phrases were: "you will be expected", "you will be capable of", "can do attitude"** [3]

Some employers now use specialist software to review their adverts and avoid unnecessary jargon or terms that can trigger gender bias, and have also found a positive effect on quality and quality.

3 Evidence that Gendered Wording in Job Advertisements Exists and Sustains Gender Inequality" – Gaucher, Friesen and Kay, American Psychological Association, 2011

3.5 Small versus large

Both employers and academics noted that many smaller companies need very specific technical skills which can be deployed immediately, whereas larger organisations often recruit based on broader criteria such as having a passion and aptitude for technology, cultural fit, and interpersonal skills, on the basis that they can provide the necessary technical training.

> ***"We found that SMEs often want specific technical skills, whereas large organisations are able/willing to teach the recruits."*** *(Educator)*

> ***"We recognise that small businesses need to be more specific in their language because they will be looking for applicants to fill a specific role, whereas large organisations can be more flexible and are able to move people around according to their skills, so they can take a longer-term view to training."*** *(Educator)*

> ***"Specific adverts are particularly important for small businesses, who are often looking for graduates with specific skills."*** *(Small employer)*

Some larger employers also gave further insight into their recruitment practices:

> ***"We advertise globally and our roles are modelled across the organisation for consistency."*** *(Large employer)*

> ***"Many large enterprises are outsourcing the really detailed technical stuff to suppliers who specialise in these fields, and focusing on the strategic management elements of the internal IT function."*** *(Large employer)*

INSIGHT

A small company perspective

We are a small but growing app development and design company, actively looking for entry-level talent. We do sometimes still need specific skills – for instance, we currently prefer candidates with experience of the PHP Laravel framework – but generally we are more interested in how you use technology outside of the classroom, rather than what you've learned during your higher education studies. A CV crammed with tech terminology, but no explanation of its application, is a deterrent.

With entry-level positions, we pay much less attention to what your degree or degree apprenticeship was called and where you studied it; we are much more interested in whether you can demonstrate a pragmatic, proactive approach to using tech outside of study – for instance if you've self-taught to design and develop your own app. At Dreamr we are very supportive of degree apprenticeships too, and see them as a vital part of the tech sector moving forward, as they enable us to develop graduates with specialist skills that are important to our own areas of expertise.

We advertise through social media and via specialist software and always conduct first interviews via a Skype call, where we are specifically looking for candidates with not just a great curiosity for tech, but well-developed soft skills and the right values to join the Dreamr team. We tend to use conventional job titles for easy signposting purposes – 'iOS developer', 'UX designer' etc. – but we then spend a lot of time crafting the copy beneath the job title to explain what it is that makes Dreamr a great place to begin your tech career, and what differentiates us from other businesses recruiting in the same area, however big or small.

Lynne Makinson-Walsh
Director of People and Culture, Dreamr

DREAMR

4. REFLECTIONS

4.1 The value of a common language

In general, both industry and academic consultees believed in the value of improving the commonality of language, and that this would better help to link education with employment.

> ***"A common language would stop a lot of the confusion faced by applicants, something I see as a Careers Adviser."*** *(Educator)*

> ***"Applicants should have a better understanding of what employers are looking for and this would enable better comparisons between roles being advertised."*** *(Employer)*

> ***"[A common language] would help course tutors to understand the environment that graduates are recruited into and the variety of roles that could be available."*** *(Educator)*

Contributions to this document are intended to help illuminate the use of language and thus help to bridge this gap which may be hindering students' understanding of their progression options.

4.2 Recognising reality

At the same time, there are notable differences between language in academia and in industry.

Section 1 of this publication shows this, with, for example, popular terms in higher education such as computing and computer science having much less resonance or much more restricted meaning in industry.

This can make it difficult for students to see the link between their degree and skills and the jobs they see advertised, and make it harder for potential recruits to present themselves to employers in the best light.

INSIGHT

Building bridges with industry

Building bridges between education and industry is important, but challenging too. With our degrees, we get a mixture of students who are either very focused and often introverted people who are interested in computer programming, or who have come to Computer Science through the clearing process and perhaps don't have a clear idea about what the degree entails. I think these two audiences both contribute to the 11% unemployed after 6-months figure – some students are so passionate about Computer Science they don't even consider a career pathway and struggle to appeal to employers, others decide at the end of their studies that a career in tech might not be for them, but value the skills they've learned.

I do see things changing, and we work very closely with industry now, with some very positive effects. In the past we ran a forum with a leading employer for over 100 final year students, and only eight turned up, as many of them simply assumed leading employers only actually recruited from Russell Group universities. Now I do think things are different, and we see employers looking for students who can hit the ground running with the right skills for work. So, we encourage our students to visit Google Campus or Tech City, to understand what is happening in the tech sector and run increasingly popular extra-curricular employability units on "Impression Management", to help our graduates as they move into the workplace. We want to give our students the technical and interpersonal skills they increasingly need in combination to be able to communicate in the language of industry when they look to find their first position.

Paul Sant
Associate Dean, Faculty of Technologies and Science,
University of Bedfordshire

University of Bedfordshire

4.3 Findings for students

Many consultees reflected on advice which could benefit students, with common themes including the following:

- **It's not all about programming**
  The research makes it clear that more needs to be done to explain to students that programming is not the only career available as a digital specialist, and that there is a very wide range of potential roles for which an IT-related education (or even a non-IT related education) can offer an excellent foundation. Graduates and potential apprentices need to consider all the skills they have developed, including the soft skills that employers increasingly require.
- **Degree apprenticeships can provide a head start**
  There is a rapidly increasing number of degree apprenticeship opportunities in digital roles, with employers reporting excellent results for both themselves and the individual. Combining a degree education with practical experience, this can offer new entrants a head start in their career, as a well as a degree without debt.
- **A complete suite of skills is not required**
  Students, particularly females, can be put off if they think they may not possess all the skills mentioned in a job advert. In reality, employers do not necessarily expect all skills to be immediately present. Sometimes the specification is more talking about the responsibilities in the role over time rather than necessarily what is expected at the outset. Potential applicants should not be afraid to ask questions to better understand requirements in both the short and longer terms.
- **Consider the context**
  Applicants would benefit from a greater appreciation of context when applying for jobs, for example considering the sector and business purpose of the organisation, its size, how long it has been established and its growth trajectory. Skillsets and expectations may differ significantly between companies, even for similar sounding roles, and an appreciation of the context will aid understanding.
- **Standing out from the crowd**
  There are useful online tools for graduates to evaluate their own CVs and identify common pitfalls in CV writing. Many employers are seeking evidence of a passion for technology and of soft skills as much, if not more, than technical capability, and CVs should demonstrate these aspects.
- **Talk to alumni**
  Alumni are often more than willing to help current students. New recruits can learn from alumni of degrees and degree apprenticeships about their experience of their programme, the employer recruitment process, and how they were able to relate what they learned in the classroom to the needs of their employer.

4.4 Findings for employers

- **Beware of jargon**
  The rate of change in technology makes it easy to use buzz words and jargon that may be confusing for potential job applicants. It may be helpful to get someone else, particularly someone not currently in a digital professional role, to read job adverts through the eyes of a student. It is also important to focus on not just the specific nature of the role, but also what makes your company different and worth working for. This can help students identify whether they would fit your organisation in terms of culture and well as competence.

- **Mind your language**
  It's important to avoid terms that could deter suitable candidates from applying. Some firms are now using software applications to screen for language that could put off particular groups of candidates, such as female applicants.

  It is also helpful to consider the skill and knowledge a candidate for a certain role might reasonably be expected to have. For example, if you are recruiting from any degree subject, different language might resonate more effectively from that targeted exclusively at computer science students. If looking for an apprentice, they will generally start off with considerably less knowledge than graduates, so tailor your language accordingly – although the approach of learning and working at the same time means they will quickly catch up.

- **Don't be overly specific**
  It can be tempting to advertise for candidates by listing a highly specific set of skills requirements. But this an unnecessarily limit the talent pool. For example, you might be seeking a software developer with experience in a particular programming language – but you could find great candidates who have all the skills you need but with expertise in a different language, who could quickly learn cross train.

- **Separate immediate and long-term need**
  It's unlikely that candidates will possess all the skills many employers ideally want on day one, and sometimes job adverts explain rather more what the job requires in say one year's time than what is essential to secure the role in the first place. Applicants, particularly females, can be deterred from applying if they don't feel they can fulfil all criteria mentioned on day one. It is helpful therefore to be clear on what are absolutely essential skills for day one versus what the job will develop into over the following months.

4.5 Findings for educators

- **Computer Science in context**
  A degree course sets out to develop a deep understanding of the subject matter and the ability to learn. In the digital world, employers very much value this broad preparation for a dynamically changing career. It is however also increasingly essential to help students understand how to apply what they are learning to both immediate job opportunities and long-term careers.
- **Develop soft skills**
  Employers are looking for confident, articulate new recruits that will work well within their business – including working in a team, engaging with clients and challenging assumptions. It is helpful to students if such capabilities are built into the degree, for example through projects, presentations and industry events, and if they are encouraged to think about how these skills can be applied in the workplace.
- **Engage industry in innovative ways**
  Often time pressures mean that educators and employers are not able to work as closely together as they would like. While meeting face-to-face regularly is extremely valuable, it can be challenging to arrange. Exploring other mechanisms, in particular using online communications and forums, can help time-poor professionals share insights and issues to the benefit of all.

4.6 Potential follow up

Several themes have emerged in this work which could benefit from further work, for example helping students to understand:

- Why different companies advertise so differently, for example the differences between small and large organisations, or the differences between companies in the digital industry itself and companies in other sectors recruiting digital specialists.
- How to respond effectively to job adverts, both those with a detailed list of specific skills not all of which they possess, and those with broader requirements, for example, a passion for technology, customer-orientation and business skills.
- The relationship, commonalities and differences between typical IT-related degree courses and common entry level digital jobs.

It is also clear that there is much to be gained by greater sharing of experience within and between academia and industry. Many employers reflected on how they had adapted recruitment practices to overcome barriers, for example separating immediate skills needs from medium-term job responsibilities, so as not to overwhelm a new graduate; increasing focus on people specifications and personal characteristics; understanding differences in typical female and male reactions to adverts; and using accessible, attractive language.

The sharing of experience to reach broader consensus would greatly benefit students too. Given that most students in the first instance use search engines to look for job roles, it would be helpful if agreement could be reached on common titles for entry-level graduate and degree apprenticeship positions, building understanding through consistent use of terminology and making the search process much more straightforward for the applicant.

5. IN CONCLUSION

This work has set out to help develop a common understanding of language used in IT-related education and employment. Whilst there are disconnects between the two, there is also a great deal of common interest in bridging the gap and helping students progress through their education into successful careers.

It is hoped that this publication offers a useful starting point for ongoing discussion between industry and academia through which an increasingly common language can be developed.

This publication will help to provide information to students, including those at school and school careers advisers, on the wide range of rewarding digital roles available in all sectors today.

The benefit will be for students, who will see a greater range of exciting career opportunities opening up; universities, whose courses and employability outcomes will be increasingly attractive to students; and employers who will be able to more easily recruit the talent they need to thrive and grow in a highly competitive globalised digitised economy.

ANNEX A

Definitions

A1 Digital specialist workforce

Roles aligned to the following Standard Occupational Classification (SOC) Codes:

1136 Information technology and telecommunications directors

2133 IT specialist managers

2134 IT project and programme managers

2135 IT business analysts, architects and systems designers

2136 Programmers and software development professionals

2137 Web design and development professionals

2139 Information technology and telecommunications professionals nec

3131 IT operations technicians

3132 IT user support technicians

5242 Telecommunications engineers

5245 IT engineers

A2 Computer science undergraduate degrees

Degrees assigned Joint Academic Coding of Subjects (JACS) Code I 'computer sciences':

I100	Computer science	The study of the design and application of electronic computer systems, including computer architectures, software and systems design.
I110	Computer architectures & operating systems	The study of the systemic structure of computer systems and the associated software which facilitates the efficient co-ordination and use of the component units.
I111	Computer architectures	The study of the systemic structure of computer systems.
I112	Operating systems	The study of software which is designed to facilitate the efficient co-ordination and use of system components.
I113	Displays & imaging	The study of the software, hardware and mathematical tools used to represent, display and manipulate computer graphics.
I114	High end computing	The study of high-performance computing using supercomputers and clusters to solve advanced computational problems.
I115	Parallel computing	The study of simultaneous calculations for complex computations.
I120	Networks & communications	The study of computer network systems and computer communications techniques/protocols.
I130	Computational science foundations	The study of the fundamental laws or principles underpinning the design, construction and use of computer systems.
I140	Human-computer interaction	The study, design and application of principles and techniques aimed at optimising the interaction between computer systems and their human users.
I150	Multimedia computing science	The area of computer science concerned with the computer controlled delivery of information in a variety of forms, including text, pictures, video, graphics and animation. Often associated with information presentation on the Internet.

I160	Internet	The study of internet-related computing including Cloud Computing.
I161	e-business	The study of the nature of e-business, its system components and applications.
I190	Computer science not elsewhere classified	Miscellaneous grouping for related subjects which do not fit into the other Computer science categories. To be used sparingly.
I200	Information systems	The study, design or application of computer systems which capture, process and transmit information.
I210	Information modelling	Concerned with the modelling of information flows within an organisation and how these flows can be optimised and incorporated into the design of a large-scale computer system.
I220	Systems design methodologies	The study of standard methodologies for the design of large-scale computer systems.
I230	Systems analysis & design	The study of the principles and techniques for the design and implementation of large-scale computer systems.
I240	Databases	The study, design or application of information systems which act as structured repositories for large amounts of information.
I250	Systems auditing	The study and development of techniques for inspecting, correcting and verifying information systems.
I260	Data management	The management of computer systems which capture, process and transmit data.
I270	Intelligent & expert systems	The study of digitally-based products and systems within manufactured goods, including telematic devices, human interfaces and reasoning for computing systems.
I290	Systems analysis & design not elsewhere classified	Miscellaneous grouping for related subjects which do not fit into the other Systems analysis & design categories. To be used sparingly.
I300	Software engineering	The study of techniques and principles for the design, construction, testing and maintenance of computer programs to satisfy the requirements of specific operational problems.
I310	Software design	Concerned with the design of computer instruction sets to satisfy the requirements of specific operational problems.
I320	Programming	Concerned with the conversion of designs into computer instruction sets to satisfy the requirements of specific operational problems.
I321	Procedural programming	Programming using procedural computer languages and environments, e.g. Pascal, Fortran, Cobol.
I322	Object-oriented programming	Programming using object-oriented programming languages and environments.
I323	Declarative programming	Programming using declarative programming languages, e.g. Prolog, Miranda.
I390	Software engineering not elsewhere classified	Miscellaneous grouping for related subjects which do not fit into the other Software engineering categories. To be used sparingly.
I400	Artificial intelligence	The study of principles and techniques for the computer-based simulation and modelling of intelligent animal behaviour patterns.

I410	Speech & natural language processing	The study of principles and techniques for the computer-based modelling and simulation of the human use of language.
I420	Knowledge representation	Concerned with principles and methodologies for the capture, representation, storage and application of human knowledge in a computer system.
I430	Neural computing	The study of computer-based hardware and software constructs which aim to model and simulate the salient features of animal nervous systems.
I440	Computer vision	The study and development of digital image perception.
I450	Cognitive modelling	The study and development of the processes involved in acquiring knowledge.
I460	Machine learning	The study and development of techniques whereby machines may gain knowledge through experience, deduction or reasoning.
I461	Automated reasoning	The study and development of techniques whereby machines may draw conclusions from facts and experience.
I490	Artificial intelligence not elsewhere classified	Miscellaneous grouping for related subjects which do not fit into the other Artificial intelligence categories. To be used sparingly.
I500	Health informatics	The study and design of systems for information capture, processing and use in healthcare.
I510	Health technologies	The study of health technology methods used to promote health, prevent and treat disease and improve rehabilitation or long-term care.
I520	Bioinformatics	The study of the application of computer-based technologies and services to biological, biomedical, and biotechnology research.
I530	Tele healthcare	The study of tele healthcare technology to enable a flexible, integrated approach to health and social care services.
I590	Health informatics not elsewhere classified	Miscellaneous grouping for related subjects which do not fit into the other Health Informatics categories. To be used sparingly.
I600	Games	The study of computer science games.
I610	Computer games programming	The study of games programming, methods of interaction and console architectures.
I620	Computer games design	The study of the use of artistic and visual communication techniques in the design and production of computer games.
I630	Computer games graphics	The study of the use of visual communications and graphics technologies in the design and production of computer games.
I700	Computer generated visual & audio effects	The study of the production of computer generated special visual and/or audio effects for use in static or moving image sequences.
I710	Computer generated imagery	The study of the techniques associated with the creation of illusion of movement in static or moving image sequences using computer generated imagery.
I900	Others in Computer sciences	Miscellaneous grouping for related subjects which do not fit into the other Computer sciences categories. To be used sparingly.
I990	Computer sciences not elsewhere classified	Miscellaneous grouping for related subjects which do not fit into the Others in Computer sciences categories. To be used sparingly.

Annex B

B1 Use of terms in digital specialist job adverts

Table 1: Popular terms, ordered by prevalence in digital specialist job adverts

Prevalence of common terms	Job adverts	Degree titles	Variance
Development	**60.1%**	3.5%	56.5%
Support	**58.7%**	0.0%	58.7%
Business	**56.3%**	8.7%	47.5%
Management	**47.1%**	6.9%	40.2%
Software	**45.4%**	7.2%	38.2%
Systems	**44.6%**	12.8%	31.8%
Technology	**40.5%**	9.5%	31.0%
Software Development	**37.3%**	1.0%	36.3%
Data	**34.4%**	2.8%	31.6%
Information	**31.7%**	13.8%	18.0%
Project	**26.7%**	0.3%	26.4%
Engineer	**25.0%**	8.2%	16.8%
Web	**24.4%**	3.8%	20.6%
Professional	**23.3%**	0.7%	22.6%
Manager	**23.1%**	0.0%	23.1%
Security	**20.8%**	5.5%	15.3%
Engineering	**19.7%**	8.0%	11.8%
Infrastructure	**19.4%**	0.1%	19.3%
Network	**16.3%**	5.4%	10.9%
Computer	16.3%	**37.1%**	20.8%
Programming / programmer	**15.1%**	0.3%	14.8%
Digital	**14.7%**	3.5%	11.1%
Cloud	**14.7%**	0.5%	14.2%
Science	13.7%	**30.8%**	17.1%
Analyst	**13.0%**	0.1%	12.9%
Database	**12.7%**	0.4%	12.3%
Hardware	**11.0%**	0.0%	11.0%
Computer Science	10.2%	**19.8%**	9.7%
Networks	**5.8%**	2.3%	3.5%
Computing	5.5%	**29.3%**	23.9%
DevOps	**4.8%**	0.0%	4.8%
Technician	**4.0%**	0.0%	4.0%
Consultant	**4.0%**	0.0%	3.9%
Games	**3.1%**	3.0%	0.1%
Electronic	**2.9%**	1.9%	1.0%
Cyber	**2.3%**	0.9%	1.4%
Tester	**1.8%**	0.0%	1.8%

The research also showed the importance of soft skills with for example over 80% of digital job adverts highlighting the need for team work:

Prevalence of popular soft skills	Job adverts	Prevalence of popular soft skills	Job adverts
Team	80.6%	Verbal	12.2%
Problem solving	25.5%	Creative / creativity	11.8%
Written / writing	24.9%		

B2 Use of terms in IT-related degree course titles

Table 2 below shows that, of the popular terms analysed, the most commonly used in IT-related undergraduate degree titles are 'computer' (37%), 'science' (31%), 'computing' (29%) and 'computer science' (20%).

Notably, these are also the only ones which are more prevalent in degree titles than in job adverts.

Table 2: Popular terms, ordered by prevalence in IT-related degree titles

Prevalence of common terms	Degree titles	Job adverts	Variance
Computer	**37.1%**	16.3%	20.8%
Science	**30.8%**	13.7%	17.1%
Computing	**29.3%**	5.5%	23.9%
Computer Science	**19.8%**	10.2%	9.7%
Information	13.8%	**31.7%**	18.0%
Systems	12.8%	**44.6%**	31.8%
Technology	9.5%	**40.5%**	31.0%
Business	8.7%	**56.3%**	47.5%
Engineer	8.2%	**25.0%**	16.8%
Engineering	8.0%	**19.7%**	11.8%
Software	7.2%	**45.4%**	38.2%
Management	6.9%	**47.1%**	40.2%
Security	5.5%	**20.8%**	15.3%
Network	5.4%	**16.3%**	10.9%
Web	3.8%	**24.4%**	20.6%
Development	3.5%	**60.1%**	56.5%
Digital	3.5%	**14.7%**	11.1%
Games	3.0%	**3.1%**	0.1%
Data	2.8%	**34.4%**	31.6%
Networks	2.3%	5.8%	**3.5%**
Electronic	1.9%	2.9%	**1.0%**
Software Development	1.0%	37.3%	**36.3%**
Cyber	0.9%	2.3%	**1.4%**
Professional	0.7%	23.3%	**22.6%**
Cloud	0.5%	14.7%	**14.2%**
Database	0.4%	12.7%	**12.3%**
Project	0.3%	26.7%	**26.4%**
Programming/programmer	0.3%	15.1%	**14.8%**
Infrastructure	0.1%	19.4%	**19.3%**
Analyst	0.1%	13.0%	**12.9%**
Consultant	0.0%	4.0%	**3.9%**
Manager	0.0%	23.1%	**23.1%**
Hardware	0.0%	11.0%	**11.0%**
DevOps	0.0%	4.8%	**4.8%**
Tester	0.0%	1.8%	**1.8%**
Technician	0.0%	4.0%	**4.0%**
Support	0.0%	58.7%	**58.7%**

B3 Variance between use of terms in job adverts and degree titles

Table 3 below orders the terms by the variance in prevalence.

Prevalence of popular terms in digital specialist job adverts and IT-related degree titles, ordered by extent of variance

Prevalence of common terms	Variance	Job adverts	Degree titles
Support	58.7%	**58.7%**	0.0%
Development	56.5%	**60.1%**	3.5%
Business	47.5%	**56.3%**	8.7%
Management	40.2%	**47.1%**	6.9%
Software	38.2%	**45.4%**	7.2%
Software Development	36.3%	**37.3%**	1.0%
Systems	31.8%	**44.6%**	12.8%
Data	31.6%	**34.4%**	2.8%
Technology	31.0%	**40.5%**	9.5%
Project	26.4%	**26.7%**	0.3%
Computing	23.9%	5.5%	**29.3%**
Manager	23.1%	**23.1%**	0.0%
Professional	22.6%	**23.3%**	0.7%
Computer	20.8%	16.3%	**37.1%**
Web	20.6%	**24.4%**	3.8%
Infrastructure	19.3%	**19.4%**	0.1%
Information	18.0%	**31.7%**	13.8%
Science	17.1%	19.4%	**30.8%**
Engineer	16.8%	**25.0%**	8.2%
Security	15.3%	**20.8%**	5.5%
Programming / programmer	14.8%	**15.1%**	0.3%
Cloud	14.2%	**14.7%**	0.5%
Analyst	12.9%	**13.0%**	0.1%
Database	12.3%	**12.7%**	0.4%
Engineering	11.8%	**19.7%**	8.0%
Digital	11.1%	**14.7%**	3.5%
Hardware	11.0%	**11.0%**	0.0%
Network	10.9%	**16.3%**	5.4%
Computer Science	9.7%	10.2%	**19.8%**
DevOps	4.8%	**4.8%**	0.0%
Technician	4.0%	**4.0%**	0.0%
Consultant	3.9%	**4.0%**	0.0%
Networks	3.5%	**5.8%**	2.3%
Tester	1.8%	**1.8%**	0.0%
Cyber	1.4%	**2.3%**	0.9%
Electronic	1.0%	**2.9%**	1.9%
Games	0.1%	**3.1%**	3.0%

Annex C

Defining Terms

In the fast-moving digital world, sometimes people use the same terms to mean different things and different terms to mean the same things. In a dynamic environment, it is not possible to be prescriptive, but rather, through discussion, greater understanding can be achieved as language continues to evolve.

As a starting point, the following list of common terms relevant to people considering entering digital specialist roles has been compiled. These arose regularly during the research, with the definitions provided here based on a range of public domain information sources. All corrections and improvements will be gratefully received at **info@thetechpartnership.com**.

This current edition of the directory of terms was published in January 2018.

Term	Typical meaning
Artificial intelligence (AI)	The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalise, or learn from experience.
Blockchain	A Blockchain is a type of data structure that identifies and tracks transactions digitally and shares this information across a distributed trust network. Transactions are recorded as completed 'blocks' and added in chronological order, creating a chain, which means all participants can keep track of transactions without central recordkeeping. The blockchain process makes it extremely difficult for a user to alter the ledger once a block in a blockchain has been stored. Originally developed as the accounting method for the cryptocurrency Bitcoin, blockchains are now appearing in a variety of multi-step transaction commercial applications.
Business Analysis	The discipline of identifying business needs and determining solutions to business problems. Solutions often include a software-systems development component, but may also consist of process improvement, organisational change or strategic planning and policy development. The person who carries out this task is called a business analyst, often shortened to BA.
Business Information Technology	The practical application of IT-related skills and knowledge to address the needs of industry.
Client	In computing, client has a specific technical meaning related to a workstation capable of obtaining information from a server.
Cloud	Cloud computing is the delivery of computing services – servers, storage, databases, networking, software, analytics and more – over the Internet. While barely a decade old, cloud computing has transformed the world of business, providing huge benefits on cost, speed and scale compared to traditional mainframe solutions.
Coding	Coding, or programming, is the process of creating software using a programming language. Software is a set of instructions for a computer to perform.
Computer Games	Software programmes in which the user manipulates an input device in response to the graphics on a screen.

Term	Typical meaning
Computer Engineering	The integration of electronic engineering with computer sciences to design and develop computer systems and other technological devices. Computer engineering professionals have expertise in a variety of diverse areas such as software design, electronic engineering and integrating software and hardware.
Computer Science	The theory and application of information and computation.
Computer Studies	A course of study devoted to using and programming computers.
Computing	The use or operation of computers to complete a task.
Cryptocurrency	A cryptocurrency is a digital or virtual currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds. Cryptocurrencies use decentralised control, worked through a Blockchain, instead of centralised money and banking systems. Operating independently from a central bank means cryptocurrencies are theoretically immune to interference or manipulation, though the anonymous nature of transactions is also a concern for financial crime.
Cyber security	The body of technologies, processes and practices designed to protect networks, computers, programs and data from attack, damage or unauthorised access.
Data analysis	The process of transforming raw data into usable information, often presented in the form of a published analytical article, to add value to a statistical output.
Data processing	Data processing is the series of operations that are carried out on data, especially by computers, to present, interpret, or obtain information.
Development	See Software Development.
DevOps	DevOps (development and operations) means a type of agile relationship between IT development and operations teams. The goal of DevOps is to change and improve the relationship by advocating better communication and collaboration.
Digital	A broad term which can encapsulate all aspects of digital technology. It is often accompanied by a qualifying term such as "digital media" or "digital marketing". It is sometimes used to refer to online interactions with customers.
Digital media	Digital media refers to audio, video, and photo content that has been encoded (digitally compressed). Encoding content involves converting audio and video input into a digital media file such as a Windows Media file. After digital media is encoded, it can be easily manipulated, distributed, and rendered (played) by computers, and is easily transmitted over computer networks.
Engineering	See Software Engineering/Network Engineering/Hardware Engineering / Computer Engineering.
Hardware Engineering	Research, design, development, testing and/or maintenance of computer equipment such as chips, circuit boards, or routers.
Information Technology (IT)	Information Technology (IT) refers to anything related to computing technology, such as networking, hardware, software, the Internet, or the people that work with these technologies.
Infrastructure	The term infrastructure in an information technology (IT) context refers to an enterprise's hardware, software, networks, data centres, facilities and related equipment used to develop, test, operate, monitor, manage and / or support information technology services.

Term	Typical meaning
Internet	The global communication network that allows computers worldwide to connect and exchange information.
Internet of things	The interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data over a network.
Machine learning	An application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.
Network	A set of connected computers. The connection between computers can be done via cabling, most commonly the ethernet cable, or wirelessly through radio waves. Connected computers can share resources, like access to the Internet, printers, file servers, and others.
Network Engineering	The process of planning, implementing and supporting computer networks.
Online	Online is the condition of being connected to a network of computers or other devices. The term is frequently used to describe someone who is currently connected to the Internet.
Program	Executable software that runs on a computer.
Programming	See coding.
Project management	The process of planning, organising and managing work to achieve an organisation's objectives.
Robotics	A branch of engineering that involves the conception, design, manufacture, and operation of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering.
Software Development	The process of programming, documenting, testing, and bug fixing involved in creating a software product. The waterfall model is a traditional method of developing software, which can be contrasted with the more recent innovation of agile software development.
Software Engineering	The application of engineering to the development of software in a systematic method. The discipline of software engineering was created to improve software quality, and ensure that software is built systematically, rigorously, measurably, on time, on budget, and within specification.
Solutions	A set of related software, hardware and/or services which solve a business problem.
System	A set of components for collecting, creating, storing, processing, and distributing information, typically including hardware and software, system users, and data.
Technician	An individual who identifies, troubleshoots and resolves problems with computer hardware, software or networks.
Tester	An individual who checks that products or systems are performing in line with their specifications and identifies bugs that need to be fixed.
Usability	The measure of a product's potential to accomplish the goals of the user, for example considering ease-of-use and visual consistency.

Annex D

Occupational areas and common entry level job titles

This table summarises typical occupational areas, job functions, job titles and skills usually sought by employers, based on frequently occurring job titles used in entry-level recruitment.

Occupational area	Typical job function	Common entry level job titles	Typical core skills required or to be developed	Typical non-technical requirements
Cyber and Information Security	Cyber Security	- Cyber Intrusion Analyst - Cyber Analyst - Cyber Risk Analyst - Forensic Technology - ICT Security Specialists - Information & Cyber Security Specialist - Internet Security Specialist - Penetration Tester - Ethical Hacker	- Analytical skills - Degree in any subject generally accepted - Project management skills	
Data, Databases and Data Management	Data Analyst	- Data Analyst - Database Analyst	- Degree in computer science, computer engineering, management information systems or related fields - SQL and SSIS skills - Experience of Agile development practices	- Communication and interpersonal skills - Analysis and problem-solving skills
Hardware, Networks, Cloud and Infrastructure	Hardware Engineer	- Design Verification Engineers - Hardware Development Engineers - Hardware Manufacturing	- Engineering, science, computer science or maths degree - Problem-solving skills - Expertise in at least one of the following: • Network engineering, mobile communications technologies • Bespoke software and hardware development and integration • Technical infrastructure design and implementation - Vendor qualifications	
	Network Engineer	- Network Designer - Network Specialist		
	Telecommunications Engineer	- Telecommunications Engineer		
	Cloud Support	- Cloud Consultant - Cloud Manager - Cloud Support Engineer	- Analytical skills	- Communication skills, written and verbal

Occupational area	Typical job function	Common entry level job titles	Typical core skills required or to be developed	Typical non-technical requirements
Digital Business	Digital Marketing	- Digital Brand Analyst - Digital Marketing Officer - Pay-per-click (PPC) Manager - Search Engine Marketing (SEM) Analyst - Search Engine Optimisation (SEO) Analyst - Social Media and Online PR Analyst - Community Manager - Content Marketing - Digital Marketing Executive - E-commerce and Conversion - Email Marketing - Mobile Marketing - Search Engine Marketing - Social Media	- Understanding of social media, analytics and research tools	- Communication skills, written and verbal
	IT Sales	- Account Manager - Customer Sales Executive - Technical Sales Assistant - Junior Sales Broker - Business Development Analyst - Sales Software / IT Executive	- Knowledge of IT infrastructure - Knowledge of business - Experience in sales	- Communication and presentation skills - Commercially minded - Resilient and driven - Results-orientated
Project and Product Management	Project Manager	- Product Planner - Project Leader - IT Project Manager - Project Consultant - Project Analyst	- Website & Content Management - CRM - Backend systems, including HR & Finance - Project Management methodologies	- Organisational skills - Communication skills
	Business Analyst	- Business Analyst - Business Process Analyst - Business Architect	- Business computing systems - IT-related qualification - Analytical skills - Project management skills	- Communication and interpersonal skills - Group working skills

Occupational area	Typical job function	Common entry level job titles	Typical core skills required or to be developed	Typical non-technical requirements
Software and Applications Design and Development	Developer	- Agile Developer - Analyst Developer - Android Developer - Back-End Developer - Coder - CSS Developer - DevOps Engineer - Front-End Developer - Full Stack Engineer - HTML Developer - iOS Developer - IT Programmer - Mobile Applications Developer - PHP Developer - Programmer - Software Developer - Software Engineer - System Developer - Systems Administrator	- Computer-related or science degree - Experience in programming in a well-known language - Familiarity with database structures and semantics - Understanding of agile methodologies - Experience as a software developer (either as a placement or an intern) - Hobbyist games development (for gaming roles) - 3D graphics techniques	- Communication skills - Interpersonal skills - Team work
	Tester	- QA Tester - Solutions Tester - Usability Tester - Test Analyst - Test Specialist		
	Web Developer	- Webmaster - Web Programmer - Web Producer - Internet Engineer		
	Games Developer	- Games System Architect - Games Programmer		
	Web Designer	- Producer - Multimedia Architect - Multimedia Designer	- Graphics or IT-related degree - Web design skills and experience - Experience of creative software suites	

Occupational area	Typical job function	Common entry level job titles	Typical core skills required or to be developed	Typical non-technical requirements
Software and Applications Design and Development	Graphic Designer	- Multimedia Designer - Digital Designer - Conceptual Designer - Visual/UI Designer - Producer - Graphic Artist - Motion Graphics Designer - Video Editor	- Web design skills - Experience of creative software suites	- Communication skills - Organisational skills
	UI/UX Designer	- UX Researcher - UI Engineer - Graphic User Interface (GUI) Designer		
	Games Designer	- Animator - Illustrator - Games Artist		
	Technical Analyst	- Solutions Analyst - Systems Analyst - Technology Analyst	- IT or related degree - Analytical skills - Experience with programming languages - Understanding of database concepts	- Communication and interpersonal skills
	Technical Consultant	- Applications Consultant - UX Consultant - Technology Consultant - IT Consultant	- Degree from all disciplines (IT of Psychology desirable for UX roles) - Experience of mobile applications - Experience of UX design - Workplace software applications	- Organisational skills - Results-orientated

About the Tech Partnership

The Tech Partnership is the network of employers collaborating to create the skills for the UK digital economy. Its work is focused on:

1 

Inspiring new and diverse talent into digital careers through our work in schools, colleges and universities across the UK.

2 

Raising the relevance and quality of digital skills training and education by setting apprenticeship standards and developing degree programmes to meet employers' needs.

3 

Enabling everyone to gain basic digital skills by promoting a common digital services framework and championing basic digital skills initiatives.

It achieves its objectives by bringing employers, government and educators on a common agenda for action on improving digital skills.

For more information please see **www.thetechpartnership.com**.

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