

# LEVELLING UP THROUGH DIGITAL, COMPUTING AND TECHNOLOGY SKILLS

GROWING THE UK DOMESTIC TALENT BASE

APRIL 2022

SOUTH CENTRAL

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# LEVELLING UP THROUGH DIGITAL, COMPUTING AND TECHNOLOGY SKILLS

## ScaleUp Institute

The ScaleUp Institute is a private sector-led, not-for-profit organisation focused on collaborating with policy makers, corporates, finance players, educators and government at a local and national level.

Our mission is to help the UK to become the best place in the world to grow a business as well as start one, and enable our existing high-growth businesses to scale up even further.



### SCALEUPS ARE PRODUCTIVE

Scaleups are more productive than their peers, generating an average of £338,000 turnover per employee.



### SCALEUPS ARE INNOVATIVE

3 in 4 scaleups have introduced or improved a product/service/process in the last three years, twice the rate of large firms, and they are significant adopters of new technologies.



### SCALEUPS ARE INTERNATIONAL

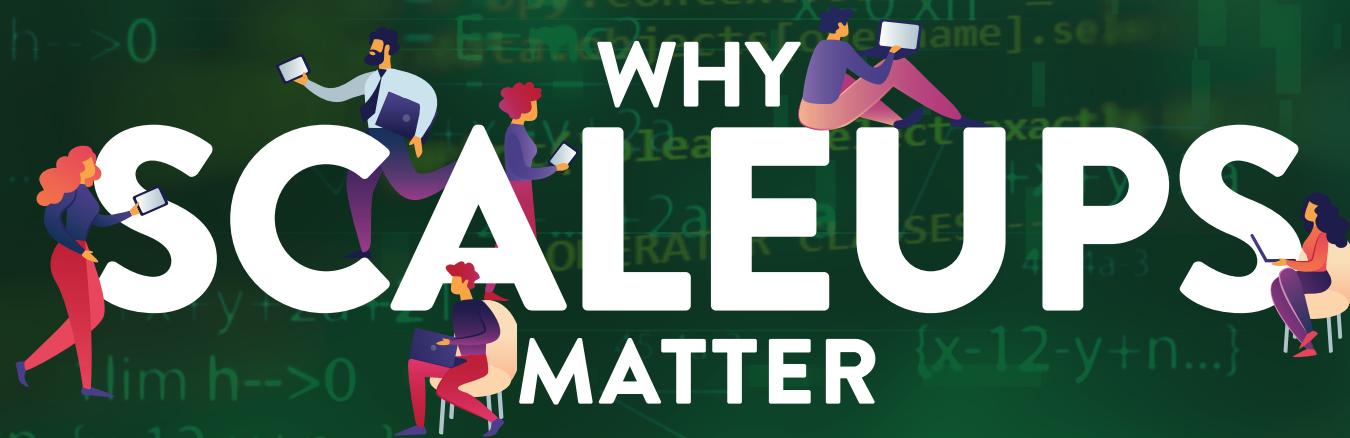
6 in 10 scaleups are involved in international trade, in a range of markets across the world. They are looking to expand further internationally especially in emerging markets.



### SCALEUPS ARE ACROSS ALL SECTORS

Scaleups span the economy: the majority of them operate in sectors outside of technology.

## WHY



### SCALEUPS CREATE HIGH QUALITY JOBS

Scaleups help create high-quality jobs with more satisfied employees – employing 3.2m workers



### SCALEUPS ARE DIVERSE

39% of all scaleups have at least one female director



### SCALEUPS ARE GOOD CORPORATE CITIZENS

Over half describe themselves as being a social business, operating in the green economy or meeting ESG goals. 70% of scaleups offer opportunities to young people through work experience, internships or apprenticeships. They offer apprenticeships at twice the rate of typical firms.



### THEY PLAN TO GROW

9 out of 10 scaleups expect to grow again in the coming year. Half expect 20%+ growth, 1 in 4 expect to achieve 50%+ growth in either turnover or employment.

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*“This is a very welcome and timely paper which makes clear: a) the need for tech and computing skills if the UK is to meet its ambitions for economic and social prosperity; and b) the gaping hole that exists in the numbers of students taking computing education, especially in schools.”*

**Eleanor Shaw, Professor of Entrepreneurship and Associate Principal, University of Strathclyde**



# The Scale of Need - The Digital, Computing & Technical Skills perspective

## SCALEUPS IN THE UK

**33,445** SCALEUPS  
**27,565** TURNOVER  
**12,600** EMPLOYEES  
**6,720** SCALING BOTH

SCALEUPS GENERATE

**> £1.1trn**  
**50% of UK SME Economy**, whilst representing less than 1% of UK companies

Across all sectors and localities of the UK

Scaleups are major employers of graduates, post graduates and PhD students. They are key providers of apprenticeships and work experience, school leaver roles

**7 IN 10** offer apprenticeships and/ or work experience  
**2 X RATE OF SIMILAR FIRMS**

**4 IN 10** employ school leavers

**8 IN 10** employ graduates

**1 IN 2** employ post-graduates or PhD students

**66%** OF SCALEUPS CITE TECHNICAL SKILLS AS THE KEY ISSUE TODAY



KEY FUTURE SKILLS



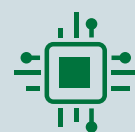
**70%** CRITICAL THINKING



**44%** COGNITIVE FLEXIBILITY

## Looking Forward

At the forefront of innovation, scaleups are extensively using emerging virtual, collaborative software and will be increasing this in 2022 and beyond.



**4 IN 10** expecting to use AI



**1 IN 3**

planning to use big data

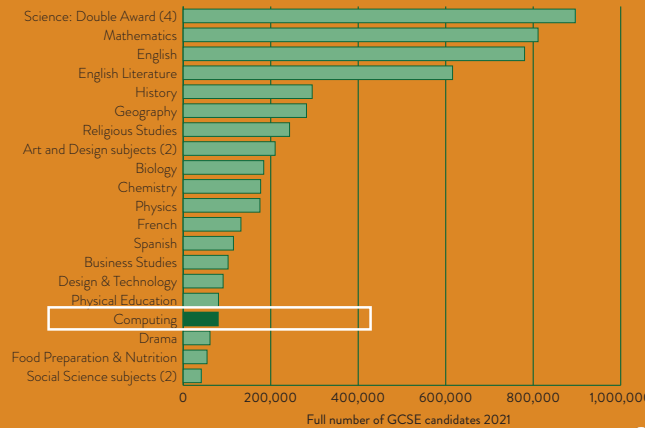


**1 IN 4**

dialling up the use of robotics and blockchain

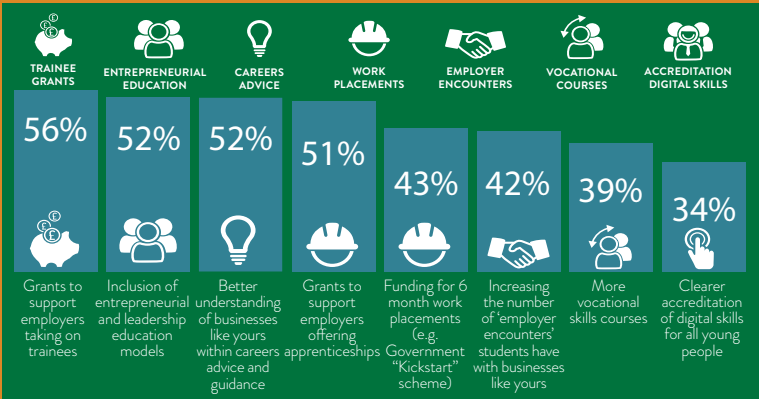
# What more can we do together on Digital, Computing and Technical Skills

## GCSE (Full Course) Results - June 2021 - All UK Candidates



Female students account for just **20.7%** of those taking GCSE  
**14.7%** taking A-Level  
**17%** fall in number of computing teachers since 2013

Coursera Global Skills Report places the UK 47th in the world for technology skills, 77th for business skills and 34th for data science

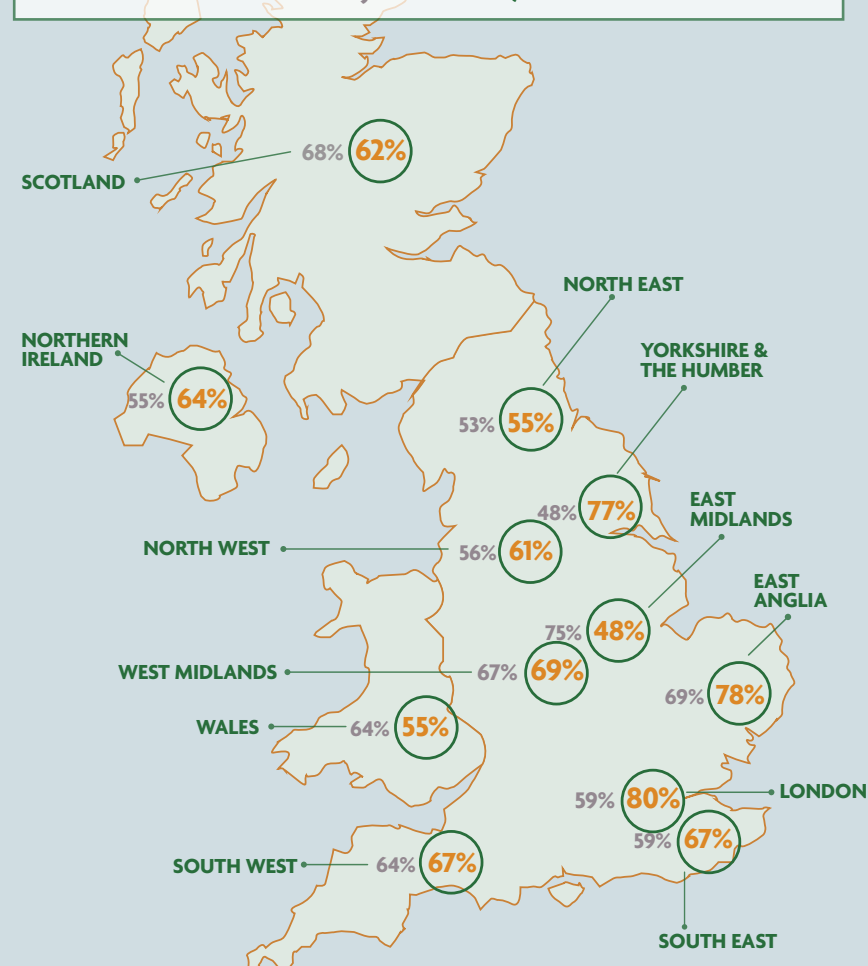


"With roughly 80 per cent of the 2030 workforce already in the workforce today, reskilling the existing workforce will be the major challenge between now and 2030. By 2030, around 7 million additional workers could be under-skilled... Severe skill shortages are predicted in basic digital, core management, and STEM skills".  
 The Industrial Strategy Council publication in June 2020

## Levelling Up with skilled technical talent

All scaleup cite access to talent as a key priority, though for some regions this is disproportionately high, presenting a need to scaleup talent across the UK.

### Access to the talent you can hire / Technical skills



## The Imperatives Ahead: Three Critical Priorities

**Priority 1: Revolutionise the school curriculum to raise the status of Computer Science across all school and higher education ages by developing a clear accreditation process across all age groups and the introduction of a compulsory examination or minimum accreditation at Key Stage 4.** This will ensure that these skills are recognised as the critical modern language and the bedrock of STEM capability, enabling as standard for all students the teaching of relevant digital skills for the future.

**Priority 2: Inspire students to see the breadth of career opportunities within their reach that Digital, Computing and Technology skills can Unlock** through boosting careers strategies; enhancing encounters with scaling employers and providing time in the curriculum for further work experience and internships alongside expanding opportunities with apprenticeships and traineeships. Raise the recognition of the value of Digital, Computing and Technology skills through a concentrated **National Campaign** between the public and private sectors including role models and broad communications channels and platforms.

**Priority 3: Expand long-term initiatives to support lifelong learning and adult reskilling** to service future economic needs and to give new opportunities for advancement to those outside formal education. The National Academy should play a key role here as it evolves.





**Adam Hale, Chair  
ScaleUp Institute**



**Alex Warner, Principal,  
Milton Keynes College**



**Irene Graham OBE,  
CEO, ScaleUp Institute**

## Foreword

Sometimes big decisions are needed to change the course of history, that's what this paper calls for.

The pandemic has accelerated the shift towards every business being able to operate digitally. This is also happening in the world of education with students being taught remotely for much of the last two years. However, mastering this shift needs different skills in all roles, going way beyond the ability to use the internet and phone apps. Digital, Computing & Technology skills are the new modern language, knowledge of those fundamentals is almost a guarantee of a high productivity job for life.

Scaleups tell us repeatedly that they desperately need more people in the UK with these skills, without them growth will be reduced and roles will move offshore. Every kind of role is affected by this change, deepening the current skills crisis. There are some excellent initiatives underway, notably the new Institutes of Technology, but they are small scale. We are calling for Computing education to be mandatory, for everyone. More people with the right skills will fill large numbers of jobs across the country. One benefit of the shift to hybrid/remote working is that people with the right skills can perform high productivity roles without moving from Southport, Scunthorpe or Swanage. We can equip the new economy while

levelling up. Achieving this won't be easy. Computing is the 17th most popular GCSE overall and 24th for female students. A big shift is needed, incremental changes to existing methods will not move the needle sufficiently.

Trying to hire more Computing teachers alone is not enough, we will need to further embrace new methods & industry partnerships.

I learnt to code as a teenager in Stockport using a Sinclair ZX81 bought with paper round money. That experience led directly to a lifetime working with Technology. 40 years later everyone should have that chance. The shift to digital is irreversible but the full revolution is still in its relatively early stages. The UK pioneered much of the technology that now underpins the world economy with Lovelace, Babbage & Turing and has the chance to lead again globally. This requires an increased intensity in collaboration between educators, academia, industry and government. Ada Lovelace wrote that she could "throw rays from every quarter of the universe into one vast focus" - it is that similar intensity of focus that we need right now.

## Executive Summary

Why technology, computer and digital skills matter - *the opportunity to level up and scale up*

The UK has a unique opportunity to be a global leader in science and technology and the Green (Net Zero) Economy. The Government has set out its intention to build the UK as a science and technology superpower, as well as recognising the ambitious skills programme needed to meet this opportunity.

Covid-19 has accelerated the process of digital transformation in all sectors of the economy. One of the few positive outcomes of the pandemic has been the increased success and acceptance of remote working. Wherever people are in the UK, if they have the right skills, they can find high-productivity roles without needing to move home. This is especially true of digital and technology-centric roles. A technologically-literate workforce is able to work across regions, embracing the trends towards remote and/or flexible working. Equipping people with the

right digital and technical skills is central to the levelling up agenda.

The challenge is to develop a workforce that is equipped with these digital, computing and technology skills - so that they can operate within today's tech-driven work environments but also create, build and deploy the technologies of the future.

If the UK fails to embrace and develop the necessary skills, high-value jobs will go elsewhere and this will harm our local economies, employment and global competitiveness. A lack of these core skills will act as a 'drag' on the pace of economic growth in particular locations, slowing down wider economic development efforts and undermining the creation of clusters of scaling businesses.

*"There are 1.2m open jobs at the moment in early careers but companies are not getting the correct people with the right skill sets. To fix that requires collaboration with the people who are creating the jobs of tomorrow - a vital point that this report emphasises."*

*"We have got the pieces of the puzzle. It is the collaboration and co-ordination that is lacking. While that's frustrating, it is also encouraging because we can instantly do something about this."*

**Sherry Coutu, Serial Entrepreneur**



## What we mean by Digital, Computing and Technology Skills

As well as general abilities such as social and business skills, a base level of technical and digital skills encompassing computer science is now a core requirement for many roles in our rapidly changing workplaces.

Teaching of these skills needs to be at the heart of the education system. This calls for more efforts by schools and further and higher education institutions, as well as increased interaction with the workplace and lifelong learning.

We need to recognise that Digital, Computing and Technology is essentially a new Modern Language which touches all aspects of our lives and we must equip our current and future workforce with the skills to use this new language effectively.

It is vital the education curriculum ensures our students have both the Essential Digital Skills - as defined in the Government Essential Digital Skills Framework – and GCSE Computer Science.

The Essential Digital Skills includes the five pillars of: Communicating (use of word processing and email applications); Handling information and content (finding and searching for information online, including assessing its reliability); Transacting (using online routes to purchase goods and services); Problem solving (use of online help functions or videos to solve issues); Safety (including controlling privacy settings and recognising suspicious links).

GCSE Computer Science covers the Fundamentals of Algorithms, including the way they are incorporated within products and services in a business context;

Programming and Data types; Data representation and Practical software development.

While these subjects are currently taught and acknowledged as critical by government and industry, Digital, Computing and Technology skills are now becoming so fundamental to society and the work environment that they should be elevated to the same footing as Maths and English. They are no longer “nice to have” but form an essential foundation for everyday life.

Computer Science should now be required to be taken at an examination level - or, as a minimum, to a level of certification that can be developed through an “accreditation system” and assessed in a similar way to that used to identify proficiency in modern languages (e.g. HSK levels for Mandarin) or music (grading for playing musical instruments, or musical theory). Accreditation can be achieved through both teaching at school and in the workplace. This accreditation process could be a role for the National Academy of SFQ.

We must change the way in which children and adults perceive computer science and technology. Industry, Government and educators need to communicate better the importance and value of these skills. Traditional methods of communication are not enough: online and social media channels are crucial in shaping young people’s views on computer science and technology as skills and cultural capital that are vital to their future.

*“If we believe that digital sits at the centre of everything, as this report highlights, how do we work to ensure that digital sits at the centre of everything in our curriculum - in the way we learn French, the way we learn music?”*

**Alison Ettridge, CEO, Talent Intuition**

*The teaching of digital skill in schools, combined with on-going digital upskilling, needs to become a national priority. This is not just a question of improving productivity, it is also an issue of creating equal opportunities and enabling people to achieve their potential.”*

**Dr. Thomas Hellmann, DP World Professor of Entrepreneurship and Innovation, Saïd School of Business**

The recently published White Paper, *Levelling Up the United Kingdom*, has a welcome recognition of the critical role that skills play in the economic development of local areas, and how this affects the national economy overall. Initiatives within the Levelling Up Paper include key announcements such as the new UK National Academy<sup>1</sup> and the recognition of the need for targeted engagement on a local and regional level to meet skills needs through the proposed Local Skills Improvement Plans<sup>2</sup> and new Institutes of Technology. These initiatives align very well to the ongoing evidence base of the ScaleUp Institute which has consistently highlighted the link between access to local skilled talent and the fostering of clusters which has a clear influence on positive local scaleup growth.

Whilst the White Paper is very welcome, the initiatives announced within it - alongside the £3 billion investment in education committed in 2021 - must result in a significant step change in practical coordinated action between the public, private and education sectors if we are to make the quantum shift needed to evolve the UK’s current and future workforce needs, and for the UK to retain a leading and competitive position in the global marketplace.

### The Business Imperative

It is not only technology companies that need digital, computing and technology skills. From the largest corporation to the smallest business, the demand for digital, computing and technology skills is increasing. These skills are particularly essential for scaleup businesses, which use technology extensively to fuel their rapid growth.

Scaleups, who operate across all UK sectors and geographies, are powerhouses for innovation, export and productivity. They are our growth engines; 33,445 scaleups contribute £1.1 trillion to the economy yearly - 50% of the overall contribution made by the UK’s 5.9 million SMEs.

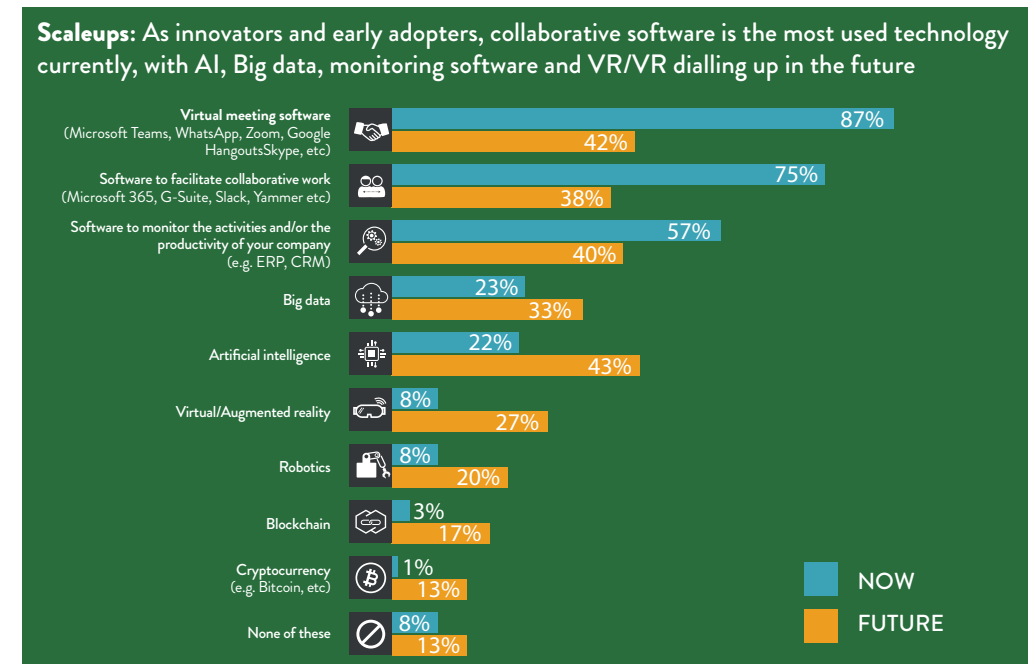
Scaleups are also at the forefront of the UK’s emerging economy, whether it be in advanced manufacturing, cybersecurity and fintech such as AML, Darktrace, Revolut and Atom Bank, or on the frontline of today’s societal issues, whether fighting the pandemic and antimicrobial resistance such as NovaBiotics, driving forward the green economy such as Recycling Technologies, or manufacturing allergen-free foods such as Moo Free.

Ensuring these businesses continue to gain access to the right talent is essential. Two-thirds of scaleup business leaders cite access to talent as a key factor in their continued growth (ScaleUp Institute Annual Review 2021). However, the coming shortage in technical skills is a key pressure point.

As vital job creators, scaleups place a premium on digital, computing and technology skills. Overall (66%) rank

1Levelling Up in the UK p190

2Levelling Up in the UK p194



technical skills to be the most important abilities in the graduates and school leavers they employ. Seven in ten (70%) - twice as many as their counterparts - offer either apprenticeships - or work experience, while one-third (37%) offer internships. The planned expansions and adaptations of the trainee and apprenticeship programme signalled in the Levelling Up paper<sup>3</sup> must be geared in a way that enables scaleup companies to use them even more effectively and extensively.

Scaleups are also early adopters of technology developments and digitisation. More than three-quarters (76%) of scaleups use software to facilitate collaborative work, and more than half (58%) use software to monitor the activities or productivity of the company. Nine in ten (88%) are now using virtual meeting software and five in ten plan even greater use of either big data (31%) or AI (40%) in the next year, with AR/VR, blockchain and robotics also increasingly on their agendas.

The Magnitude of the Gap that needs Closing

While these evolving growth opportunities are fuelling a huge and increasing demand for digital and technology roles, the UK faces a digital, computing and technology skills gap - one which threatens to widen without further urgent combined action to resolve it.

As the recent Kalifa Report (February 2021) observes, “*The UK’s education system provides a solid foundation [..but...] there appears to be a mismatch between the skills and knowledge being delivered and the needs of our society. This is an issue which spans both further education and higher education.*”<sup>4</sup>

The Learning & Work Institute has concluded that the UK is heading towards a “catastrophic” digital skills shortage. It reports that the number of young people taking IT skills at GCSE has fallen by 40% since 2015 (which is pronounced at female student level<sup>5</sup>). It also found fewer than half of UK employers believed their newest recruits from education had the necessary advanced digital skills. However, 60% of businesses expected to become increasingly reliant on such abilities over the next five years, while 76% feared the lack of digital skills would hit their profitability.

The Report on Jobs issued in May 2021 by the Recruitment & Employment Federation (REC), in conjunction with KPMG, states that the overall growth in UK job vacancies is at its highest since 1998, and in particular, “*The steepest increases in vacancies were seen in IT & Computing and Hotel & Catering.*”

Recent analysis of the jobs market shows that there was a 50% rise in overall UK tech job vacancies advertised in 2021 compared to 2020. Since February 2021, there have been consistently over 100,000 tech job vacancies per week on Adzuna.<sup>6</sup> Recent work undertaken by the ScaleUp Institute with Talent Works has also revealed an extremely high demand for Software Architects and Software Engineers, and for example, advertised software developer roles continued to grow in 2021, with an increase of 151.9% from 2020.

However, despite this demand the teaching capacity to deliver these skills is under pressure. The number of teachers delivering computing lessons in England decreased from 15,400 in 2013 to 12,719 in 2021 - a fall of 17.5%.

The Industrial Strategy Council publication in June 2020<sup>7</sup> noted the relative weakness of UK skill sets in the projected workforce over the next ten years across all disciplines. It stated, “With roughly 80 per cent of the 2030 workforce already in the workforce today, reskilling the existing workforce will be the major challenge between now and 2030. By 2030, around 7 million additional workers could be under-skilled... Severe skill shortages are predicted in basic digital, core management, and STEM skills.” The CBI estimates that 90% of the UK workforce will need to be reskilled by 2030<sup>8</sup>. For example, the RAC estimates that just five per cent of the UK’s current cohort of vehicle technicians are currently qualified to work on electric cars<sup>9</sup> and the Institute of the Motor Industry predicts a shortfall of 35,700 technicians by 2030<sup>10</sup> (this particular issue was also identified by an Oxfordshire-based scaleup<sup>11</sup> in the 2021 Annual Scaleup Review) .

If we are to close these gaps with home-grown talent the UK not only needs to nurture these skills among the young, but also do more to reskill the existing workforce and expand the capacity in our teaching profession by harnessing private sector resources effectively.

The need for collaboration, cooperation, and coordination

The Levelling Up White Paper, the Skills for Jobs White Paper and wider policies, including the National Skills Fund, T-Levels and planned expansion of Institutes of Technology and apprenticeship programmes - must all play their role in harmony and at pace if we are to close the burgeoning gaps. Crucially, they must also embrace working with the private scaleup sector to align to our growth company needs.

An even more coordinated approach with industry is required with digital, computing and technology skills embedded across all education platforms, if we are to

respond to the existing shortages as well as to achieve our ambitions laid out in the recent R&D People and Culture Strategy which looks to build a stronger R&D focused talent base.<sup>12</sup>

Industry must also step up and work in tandem with educators and government at all levels to foster the skills required.

Getting our UK talent strategy right across the spectrum - from school to industry, leveraging work experience, internships, apprenticeships and lifelong learning - will support the growth of our broad-based economy and burgeoning scaleup community.

Across the UK there are impressive examples of efforts being made to fill technical and digital skills gaps. These include innovative programmes from the private sector working jointly with the Government.

There are other examples including the Careers Hubs through the [Careers and Enterprise Company](#), [Digital Boost](#), the [Digital Skills Group of the British Computer Society](#), [F4S](#), [Google Digital Garage](#), [Microsoft’s Digital Skills hub](#), [Multiverse](#), [Speakers for Schools](#), [Springpod](#), [Workfinder](#), and the [National Centre for Computing Education](#). Yet these are not always perhaps as joined up, or coordinated as they might be.

The newly announced UK National Academy should have a vital role to play in this coordination effort and become a key interlocutor between the private and education sector. The focus upon skills by the Chancellor in the 2022 Mais Lecture was also welcome.

Beyond seeking to embed further this cross-societal collaboration there must be added investment / focus on building on what works at faster and greater scale - rather than ‘reinventing the wheel.’

The Imperatives Ahead: Three Critical Priorities

Working with partners, the ScaleUp Institute and the South Central Institute of Technology believe there should be a clear, simultaneous focus on three critical priorities in the short term if the opportunities available are to be seized to drive forward our scaling economy.

These priorities are essential foundations for a sustainable and domestically grown skills pipeline. We explore them in further detail below.

Priority 1

**Revolutionise the school curriculum to raise the status of Computer Science across all school and higher education ages by developing a clear accreditation process across all age groups and the introduction of a compulsory examination or minimum accreditation at Key Stage 4.**

This will ensure that these skills are recognised as the critical modern language and the bedrock of STEM capability, enabling as standard for all students the teaching of relevant digital skills for the future.

Priority 2

**Inspire students to see the breadth of career opportunities within their reach that Digital, Computing and Technology skills can Unlock**

through boosting careers strategies; enhancing encounters with scaling employers and providing time in the curriculum for further work experience and internships alongside expanding opportunities with apprenticeships and traineeships. Raise the recognition of the value of Digital, Computing and Technology skills through a concentrated National Campaign between the public and private sectors including role models and broad communications channels and platforms.

Priority 3

**Expand long-term initiatives to support lifelong learning and adult reskilling**

to service future economic needs and to give new opportunities for advancement to those outside formal education. The National Academy should play a key role here as it evolves.

“There is high demand for digital and technology skills, and providing a talent pipeline is important for UK Finance members and the wider economy. The digital economy is highly interdependent and a core element of the infrastructure for productivity and growth but also for inclusion and community cohesion. The paper has important recommendations and the banking and finance sector is committed to continue to play our part in building the skills and opportunities needed for the future.”
   
 Stephen Pegge, MD Commercial Finance, UK Finance

3Levelling Up in the UK: p 195

4https://www.gov.uk/government/publications/the-kalifa-review-of-uk-fintech

5Female students account for just 20.7% of those taking GCSE, which reduces still further at A-level to just 14.7%.

6https://technation.io/news/tech-hiring-at-its-highest-level-for-five-years/

7https://industrialstrategycouncil.org/sites/default/files/attachments/Rising%20to%20the%20UK%27s%20skills%20challenges.pdf

8https://www.cbi.org.uk/articles/learning-for-life-funding-a-world-class-adult-education-system/

9https://www.ft.com/content/cc6e39c9-d83c-47f4-a419-cdbee40c92

10https://tide.theimi.org.uk/industry-latest/news/2026-marks-cross-roads-ev-skills-gap

11https://www.scaleupinstitute.org.uk/stories/the-figaro-shop/

12 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\_data/file/1004685/r\_d-people-culture-strategy.pdf



# Revolutionise the school curriculum to raise the status of Computer Science across all school and higher education ages by developing a clear accreditation process across all age groups and the introduction of a compulsory examination or minimum accreditation at Key Stage 4

1

Digital, Computing and Technology skills are vital to the modern economy, but our education system is not keeping up with employer demand and the job opportunities that will be available to young people when they enter the world of work.

It is vital that Computer Science be grounded in practical application with industry engagement, making the subject even more relevant to jobs and career paths. This will allow practitioners to influence the design and delivery of computing science education and so increase its applicability to careers. This should take place from the earliest possible opportunity in formal education, with clear connections and engagement made in early years learning as well as at KS4.

The first twenty years of the century saw a substantial decline in the number of teachers of computing. The number of teachers delivering computing lessons in England decreased from 15,400 in 2013<sup>13</sup> to 12,719 in 2021 (a fall of 17%), while the number of secondary pupils has continued to increase. This trend had been noted previously in the Royal Society's follow up to its 2017 report, *After the reboot: computer education in schools*.

The total number of hours of computing taught has also decreased from **152,000 hours in 2013 to just over 100,000 hours in 2021**.

**Table 1: Computer science and ICT Teachers in England between 2017/18 and 2020/21**

		2017/18	2018/19	2019/20	2020/21
<b>COMPUTER SCIENCE</b>	All teachers of years 7 to 13	3,599	3,954	4,305	6,049
	Numbers of hours taught for years 7 through 13	27,881	31,190	33,641	51,567
<b>ICT</b>	All teachers of years 7 to 13	9,783	8,834	8,069	6,670
	Numbers of hours taught for years 7 through 13	78,806	71,148	64,426	49,288
Total number of teachers for ICT and Computer Science		13,382	12,788	12,374	12,719

Source: School workforce in England, Explore Education Statistics (<https://explore-education-statistics.service.gov.uk/data-tables/school-workforce-in-england>)  
NOTE: Teachers were counted once against each subject and key stage they taught at, irrespective of the time spent teaching that subject and key stage. Therefore teachers may be counted against multiple subjects.

The [National Centre for Computing Education](#) was created in 2018 in response to this shortage of teachers. Funded by the Department for Education and run by a consortium of STEM Learning, including, BCS - the Chartered Institute for IT, and the Raspberry Pi Foundation, it aims to support the teaching of computing in schools and colleges from Key Stage 1 to A-level. In 2020 it launched its Teach Computing curriculum. To date, the Centre has trained more than 1,300 teachers to teach Computer Science GCSE. This initiative should continue to be supported and expanded.

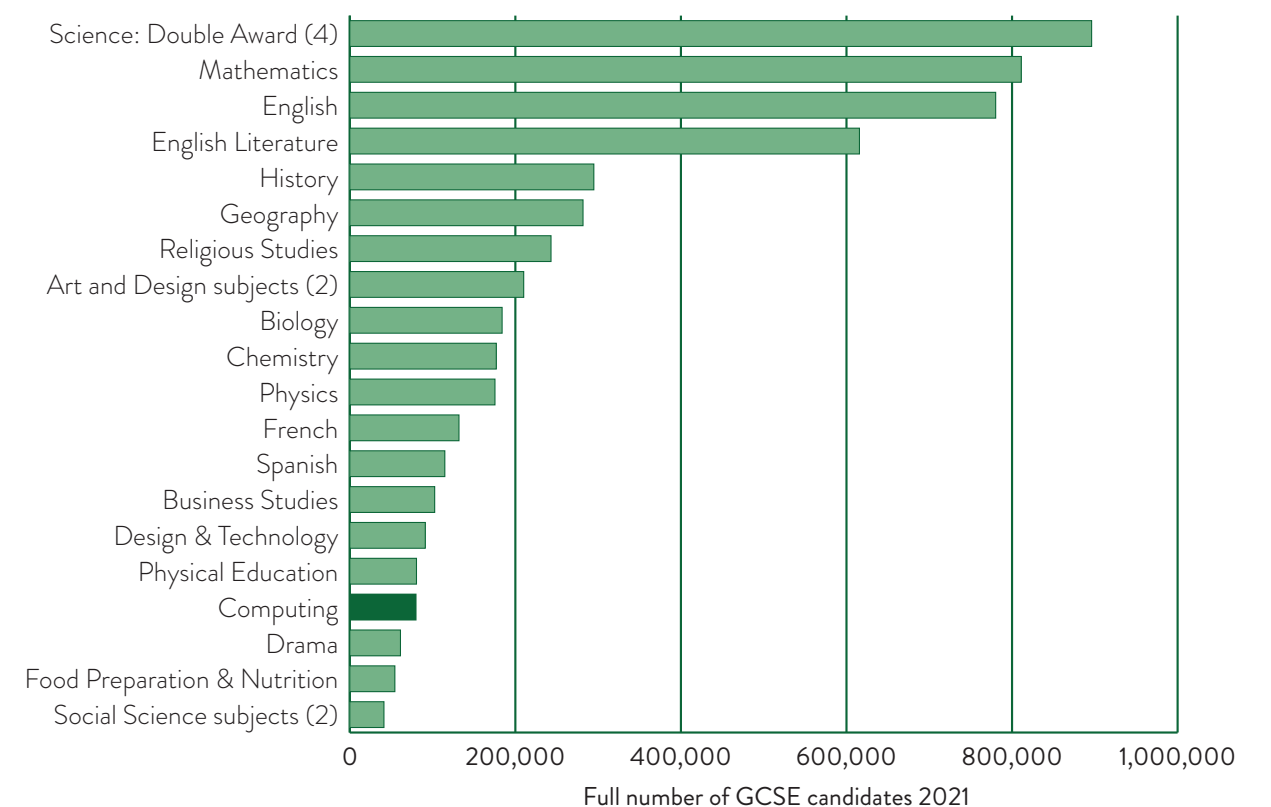
Schools have also been working to provide these vital technology skills, but are facing a number of barriers. Hiring teachers with the right skills and knowledge is a challenge when education must compete with the high wages of the technology sector. Added to this is the low status of Computer Science. The way the subject is taught and assessed can both present problems and this is compounded by the very different approach schools take to it. Some focus more on the history and the social context of computing, rather than the technical skills of programming.

Since 2014, Computer Science has largely replaced ICT and Technology is now the "T" in STEM. In England, computer science is a "foundation" subject, required as part of the national curriculum up until GCSE level (Key Stages 1 - 4), but it is not mandatory to take an exam. This is a model broadly followed by Northern Ireland, Scotland and Wales, with Computer Science a component of the Scottish Higher system.

While Computer Science is a critical new Modern Language and a bedrock of STEM capability, the numbers of pupils taking the subject at GCSE and A-level are not significantly increasing and are far behind many other subjects.<sup>14</sup>

As the table illustrates, Computer Science is not widely taken within the UK. The Computing GCSE is ranked only 17th with just 79,964 taking the subject in 2021. The French GCSE was taken by 131,887 pupils with another 114,795 taking Spanish and 38,272 sitting German. In total, that is nearly four times that of Computing.

**Graph 1: GCSE (Full Course) Results - June 2021 - All UK Candidates**



These numbers fall rapidly at A-level. In 2021, Computing A-level was the 18th most popular subject: 13,829 papers were taken (up 11.3% in 2020). By comparison, 71,235 students took Psychology, 42,091 Sociology and 18,473 Politics.

We see the same trends repeated in Scotland where numbers have either dropped or remained static. In Highers (GCSE equivalent), the number of students taking Computing Science has fallen from 4,454 in 2016 to 3,377 in 2021, making it the 16th most popular subject. At Advanced Higher (A-level equivalent) 565 papers were taken in 2021, just seven more than in 2016.

<sup>14</sup> In England, entries for Computing A-level increased by 11% in 2020, compared to 2019, from 10,550 to 11,730

As well as falling short of delivering the numbers of digitally-literate students required to drive the future economy, we also see a strong gender imbalance in the study of Computer Science. **Female students account for just 20.7% of those taking GCSE, which reduces still further at A-level to just 14.7%**<sup>15</sup>. This is a significantly lower proportion than exists across other STEM subjects. In Northern Ireland, only 69 girls took the GCSE in 2021; in Wales just 60 girls took A-Level Computing in 2021 and in England, girls made up just 14.7% of the 2021 A-level Computing cohort. Although this represents a slight rise since 2018 and 2019, when it stood at 11.7% and 13.2% respectively, it is still surprisingly low.<sup>16</sup>

This imbalance is reflected at university level with women representing only one fifth of computer science applicants in the 2022/2023 academic year<sup>17</sup>. We see this same trend replicated in work, 29.5% of the UK’s fintech workforce are female and only 25% of FinTechs have at least one female co-founder.<sup>18</sup>

It is clear that a revolution in the way that these in demand skills are supported throughout education and lifelong learning is critical, with much more needings to be done to raise UK levels of literacy in coding and digital skills among the UK workforce. These skills also need to be distributed more evenly across the population, so that opportunities are available equally without a gender imbalance.

15 JCQ (UK except Scotland)

GCSE: <https://www.jcq.org.uk/wp-content/uploads/2021/08/GCSE-Full-Course-Results-Summer-2021.pdf>

A level: <https://www.jcq.org.uk/wp-content/uploads/2021/08/A-Level-and-AS-Results-Summer-2021-v3.pdf>

Scotland – Highers & Advanced Highers: <https://www.sqa.org.uk/sqa/94723.html>

16 This growth has also been repeated at A-level where we have seen the proportion of girls studying the subject in England up to 14.5% in 2020, from 13.2% in 2019 and 11.7% in 2018.

17 <https://www.computerweekly.com/news/252513659/Computer-Science-degree-applications-up-by-13>

18 [https://assets.ey.com/content/dam/ey-sites/ey-com/en\\_uk/topics/banking-and-capital-markets/uk-fintech-census-2019/ey-uk-fintech-census-2019.pdf](https://assets.ey.com/content/dam/ey-sites/ey-com/en_uk/topics/banking-and-capital-markets/uk-fintech-census-2019/ey-uk-fintech-census-2019.pdf)

### We need combined education, academic & industry partnerships

We recognise that this report comes at a time when the problems faced by the education system have been greatly magnified by the pandemic. However, the time of greatest stress can also be the best time for radical change. The recommendations we make are designed to create a societal shift that recognises digital, computing and technology skills are critical to our ever-changing world.

Educators will need support from both public and private sectors to bring that about.

For school leavers and graduates of higher and further education, the challenge is to ensure they have the opportunity to gain the fundamental Digital and

Technology skills necessary for the evolving workplace. For adults, the need is to keep open the wide range of opportunities available by providing easy access to this fundamental knowledge and reskilling.

No one player working alone can achieve the skill shift needed.

The urgent requirement to develop a deeper and sustainable workforce pool skilled in digital, computing and technology calls for - more than ever before - a combination of industry, education, academia and public sector working as one to support the education process.

It means enhancing joint industry and education teaching forums and

opportunities; providing enhanced access to work placements and joint development of teaching curricula. Initiatives need to be even better “joined up” and greater funding given to those working so they can deliver at scale.

Increased interconnectivity between education, academia and industry will be fundamental to enabling a digital and technological savvy workforce.

### Raising the Status of Computer Science

Children must of course learn English and Maths to a certain standard. We effectively make competence in these subjects a bare minimum for progression in further and higher education, or entry into the vast majority of careers. However, in the modern economy virtually every one of those children finds themselves handling digital services, computers and technology every day as they progress through education or into job roles.

We therefore believe the status of **Computer Science** should be elevated in schools.

There is substantial debate on whether Computer Science (encompassing Digital, Computing and Technology skills sets - see box above) should be a mandatory subject for examination. We believe there is merit to this proposal from the evidence of the impact of introducing other compulsory examination subjects. Putting a level of examination in place for all students up to Key Stage 4 and making it more widely available at Key Stage 5 (A Level and Scottish Highers) would demonstrate its equal importance as Maths or English Language.

The compulsory subjects of Maths, English Language and Science: Double Award GCSEs are currently each studied

by **ten times** as many pupils as the Computing GCSE.<sup>19</sup> **The introduction of science as a compulsory subject in 1989 dramatically increased science literacy.** A study conducted in 2001 showed the average test score of students who had experienced compulsory school science from the ages of 11 to 16 to be significantly higher than those who had not.<sup>20</sup>

The core skills of Maths and Computer Science strongly benefit one another with numeracy, algorithms and data essential components in programming. These subjects are mutually reinforcing and will ensure school leavers are afforded an equal chance to bring the skills they need to the world of work. This means there are two possible options for mandatory examination: **A - to include a compulsory computer science module within all Mathematics assessment at GCSE; B - a requirement to undertake Computer Science at GCSE.**

The proposal to ensure examination takes place echoes the findings of the Logan Review<sup>21</sup> of the Technology Ecosystem in Scotland. It is reflected in the Digital Technology Education Charter launched by Toni Scullion, a computing science teacher, who was inspired by the Logan Review. It mirrors Uruguay, whose government in 2008 gave a laptop to every secondary school pupil and made technology education a core part of the curriculum for all. The country now has a thriving technology industry that is significantly ahead of its peers.<sup>22</sup>

A further option would be to encourage the development of a third-party accreditation that is recognised within education but external from GCSE and A-level processes. This could be modelled in a similar vein to the UK music grading system, which is widely undertaken and provides a comprehensive measure of aptitude in a specific discipline as well as providing UCAS points, or some of the modern language protocols such as that adopted in the HSK qualification for Mandarin. Undertaken in a similar manner to Music Grades means private sector ‘freelance’ teaching and examiners can also be leveraged from multi backgrounds.

The Digital Functional Skills (DFS) qualification, currently under consultation by Ofqual, offers a possible framework into which this certification of competency could be developed. Though it would need to include higher levels of competency and increase expertise to include programming as a core digital skill.<sup>23</sup> The UK National Academy, now under development, could also be a key enabler of this.<sup>24</sup>

19 See Graph 1 above

20 A study conducted in 2001 found that “the average test score of students who had experienced compulsory school science from the ages of 11 to 16 was found to be significantly higher (p = 0.014) than that of students for whom school science was optional at secondary level.” <https://www.tandfonline.com/doi/abs/10.1080/00131880010021294>

21 <https://www.gov.scot/publications/scottish-technology-ecosystem-revi>

22 Financial Times, Uruguay’s tech scene nears critical mass, April 2021 <https://www.ft.com/content/40dafb4e-5led-499c-8613-004f698e1c14>

23 <https://www.gov.uk/government/publications/digital-functional-skills-qualifications>

24 Levelling up the United Kingdom <https://www.gov.uk/government/publications/levelling-up-the-united-kingdom/levelling-up-the-united-kingdom-executive-summary>

### A third-party accreditation for Digital, Computing and Technology skills

This paper proposes that digital, computing and technology skills education could adopt a transparent accreditation - grading process - similar to that of the UK music grading system. The Music Grading system provides a comprehensive measure of aptitude that exists external from the qualifications of GCSE and A-level, but offers a nationally recognised certification that can provide UCAS points.

Digital, Computing and Technology skills could mirror the current eight grade music system, taking Grade 1 as an elementary level start level and rising to Grade 8 for advanced students. The breakdown currently runs as follows:

- Grades 1 to 3 are beginner level;
- Grades 4 to 6 are intermediate;
- Grade 5 with includes a further theritical compoent and acts a gateway for the advanced Grades 6, 7 and 8 (which provide UCAS points).

This system allows students-of any age- to progress from Grades 1 to 8 and receive a structured education from novice to expert in their chosen discipline, but also has the flexibility for students to enter at mid-level. This can be achieved by skipping the early grades and starting at Grade 5 with an assessed exam. This system would also have the advantage of been available to children at a young age, based on competency rather than age group and encouraging early involvement. Likewise it can be used for lifelong adult education and offers clear paity and understanding of employees.

Flexibility coupled with a solid certification is key to providing certainty for employers and usability for students. This system could be used as an assessment of Digital, Computing and Technology skills as a whole, but also specialist components such as proficiency in Python, C and C++, or HTML. This would be much the same relationship as grading in musical theory and specific instruments. A central governing body could provide oversight to the development of a syllabus that draws from innovative private providers, such as Grasshopper app, Crunchzilla, and CodeMonkey, and seeks to encompass wider certifications such as those provided by Google and Microsoft The National Academy could have a role to play here. On the teaching front if this accreditation route is undertaken in a similar manner to Music Grades it means private sector ‘freelance’ teaching and examiners can also be extensively leveraged from multi backgrounds, including those in existing digital skilled/ tech roles / jobs.



## Structural challenges

In addition to broader pupil benefits, a mandatory Computer Science component to GCSEs to examination level, may help to navigate issues which can currently limit uptake of the subject from a structural and resourcing perspective within the curriculum.

For instance, in a recent Ofsted research paper which looked in detail at the challenges of offering certain subjects for examination, one independent school observed: “We absolutely feel like our students should be learning to do computing and that that should be on offer, but computing A level, statistically, ... it’s just where everyone crashes and burns... So we don’t offer computing and I think having talked to [other local schools] they take exactly the same position, it’s too difficult.”<sup>25</sup>

By requiring Computer Science to be subject to examination at Key Stages 4/5, the burden is removed from individual schools facing disincentives to offer what is seen as a “difficult” subject despite their recognition of the value it will have for pupils. Equally, if Computer Science is required in this way and begins to be included in schools’ performance measure scores, it will create a further precedent for high quality teaching.

We should also continue to embrace alternatives to traditional schooling methods across all school ages, including exploring greater usage of the “flipped

classroom” model and practical skills focused qualifications provided by the “T-level” and Institutes of Technology (IoT). In this regard, the new T-level for Digital Production, Design and Development starting in September 2021 (which includes software development) is welcome, as is the additional support it is set to receive, though this needs to be assessed for its impact, so it can be appropriately embedded and expanded for the long term.

We believe these dual approaches will encourage more pupils to keep studying the subject, encourage diversity, and tackle current gender disparities – critically building a sustainable talent pipeline equipped for the roles of today and tomorrow.

This has to involve utilising private sector talent in order to bring industry knowledge into education. We can see this happening already within the IoT system, where large numbers of staff are being recruited as dual professionals – individuals with current experience in industry becoming teachers and mentors for learners.

The Royal Society Data Science Taskforce calls these “braided careers,” meaning three days in industry and two days in academia.<sup>26</sup> Currently use of dual professionals is being done by each IoT on an individual basis and relies on the goodwill and flexibility of employers to release staff. Government should continue to encourage companies to share their most knowledgeable employees and build upon this base of dual professionals.

Another interesting new example is [UA92](https://ua92.ac.uk), the university academy established by former Manchester United player Gary Neville, which explicitly draws on the strategies and mindset of elite sport and which is focused on recruiting people who have not considered higher education; its degrees are awarded by Lancaster University and all undergraduates do regular work placements with a curriculum designed in consultation with business partners and qualifications built around business, media, sport and digital.<sup>27</sup> Similarly serial entrepreneurs are taking a lead role in developing the skills for the future: The Livingstone Academy is a prime example of this and a model that can be replicated and embedded. National and local environments need to ensure unnecessary ‘red tape’ do not block such innovative solutions.

<sup>27</sup> <https://ua92.ac.uk>

*“The current focus on maths, geography, history, etc., needs up-ending and aligning to the real world. Vocational skills such as simulation, digitalisation, responsible leadership, environmental innovation, etc., require the combination of many academic areas in order for an individual to be equipped for the modern world.”* **Manufacturing & Engineering Scaleup**

# Inspire students to see the breadth of career opportunities within their reach that Digital, Computing and Technology skills can unlock

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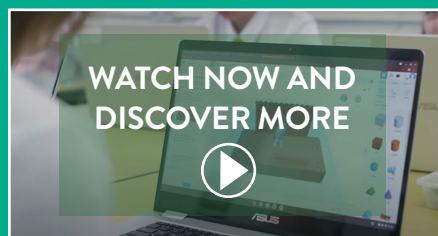
<sup>25</sup> p.16, 2017 [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/649891/Perceptions\\_of\\_subject\\_difficulty\\_and\\_subject\\_choices.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/649891/Perceptions_of_subject_difficulty_and_subject_choices.pdf)

<sup>26</sup> <https://royalsociety.org/-/media/policy/Publications/2018/07-09-18-braided-careers-teaching.pdf>

## The Livingstone Academy - A key example of a leading entrepreneur working with the education sector to develop STEAM and digital education solutions for the future generation

The Livingstone Academy in Bournemouth inspired by Ian Livingstone and working with the Aspiration Trust opened this STEAM academy in September 2021. This STEAM academy focuses on science, technology, engineering, art and mathematics with its priority subjects on art in both traditional and digital media. It currently has 210 students and will ultimately cover 1,500 students. It is the 16th school run by the Aspirations Academies Trust.

As Sir Ian Livingstone says “Creativity and computing are vital skills for the 21st century. Robots and AI are going to do the jobs which involve repetition so there is no point in teaching children like robots.” The academy aims to move young people from simply being digital consumers to being digital creators. “They must be in the driving seat of technology, not just in the passenger’s seat,” says Sir Ian. The digital and computational skills that children acquire in the academy will be highly transferable and critical in a world that is increasingly interactive and digital.



The enhancement of digital, computing and technology skills must also be linked to more effective pupil engagement with the fast-changing world of work. This is essential so that students can benefit from the practical experience they need for a technologically advancing society and emerging job roles, such as .NET developers, Software Architects, and Software Engineers, and demand for skills in AI, Big Data, creative and design, across all sectors and geographies of the economy.

Learning these skills from as young an age as possible will significantly raise children’s self-belief in their ability to master them and help to break down current stereotypes about their value. This will involve evolution and change to the current school curriculum, but, while these changes are challenging, they are essential in providing the necessary skills for young people.

Much has been done over recent years to build on the connection between schools and employers. This includes the government’s recent announcement of 2,000 new AI scholarships, as part of its new AI strategy,<sup>28</sup> as well as the recently announced increase in apprenticeship funding and the creation of 24,000 traineeships. The Levelling Up White Paper has expanded this, with an increase in funding for apprenticeships in England to £2.7bn by 2024-25, and an enhanced recruitment service for SMEs. This builds on the work of the 2018 [Careers Strategy](#) and the [Skills for Jobs: Lifelong learning for opportunity and growth](#) white paper (published January 2021).

**Education and employers must embrace each other to provide more work experience, internships and options for apprenticeships.** These will reinforce skills by providing a practical application, as well as developing “digital” skills that are outside the GCSE Computer Science curriculum.

Effort also needs to be made to change the way in which children and adults perceive computer science and technology. Industry, Government and educators need to communicate better the central importance of these skills in their ongoing messaging and the significant value put on them by employers, as well as to the industries of the future. A coordinated National Campaign, including use of modern digital communication channels, should be developed to ensure the whole population embraces and understands the essential nature of these skills. School leavers, Graduates and those already in employment should all be clear these skills are vital to their future.

## What scaleups want and how they are responding to the skills challenge

Scaleup leaders have expressed a desire to do more for our emerging generation. They are twice as likely as non-scaleups to offer apprenticeships, internships and work experience. This presents an opportunity for government and educators to link students with dynamic local scaling firms by utilising the existing system of business

<sup>28</sup> <https://www.gov.uk/government/publications/national-ai-strategy/national-ai-strategy-html-version#pillar-1-investing-in-the-long-term-needs-of-the-ai-ecosystem>

encounters<sup>29</sup>. These businesses are actively seeking workers as they grow and, as highlighted, are at the forefront of innovation. Students will not only improve their technical skills but also learn about entrepreneurship in such environments.



29 This has so far meant that schools are expected to meet the Gatsby Benchmarks. These include, a requirement for a stable careers programme under a “Careers Leader”; linking their learning curriculum to careers education; providing encounters with employers (as a minimum one meaningful encounter with an employer per school year from the age of 11) and opportunities to experience workplaces. The Skills for Jobs white paper further built upon these measures including the requirement that schools provide independent career guidance from year 7 and publishing updated statutory guidance for careers. It also supported the continued rollout of the Careers Hubs, which have been instrumental in increasing young people’s regular engagement with employers.

## Job Opportunities and Roles

Scaleups are major employers across sectors and localities of the UK economy. They serve as powerhouses for innovation, export and productivity, through areas as diverse as cybersecurity, life sciences and the green economy.

Scaleups are vital high skill job creators at the forefront of technology and they place a premium on digital and technology skills. Two-thirds (66%) of scaleups rank technical skills as their most essential need in the graduates and school leavers they employ. 33% of scaleup leaders want to see clearer accreditation of digital skills for all young people and 39% more vocational skills courses. And this ranking will grow as 40% plan even greater use of AI in the next year, 31% plan to use big data, and significant expectations to increase use of AR/VR, robotics and blockchain technologies (ScaleUp Institute Annual Review 2021).

In terms of specific technical skills, 43% of job adverts by scale ups in 2020 were seeking data skills, 44% seeking technology skills and 35% business skills (Adzuna). This is very different from skills sought by growing companies five years ago or skills sought by large companies and SMEs.

Scaleups require the best talent to fuel their innovation but with the UK lagging far behind other countries on proficiency of our workforce in technical skills (24th in Data Proficiency and 23rd in Technology, source: Coursera Global Skills Index), many are looking overseas for technical talent. A study between the ScaleUp Institute and TalentWorks found that the top roles scaleups sought to recruit from overseas included Developers (c. 8.33%), Software Architects (16.67%), and Engineers (c. 21.88%).

A deep dive into specific talent gaps experienced by scaleups has also highlighted a range of skill sets and roles that are proving challenging to fill, including Natural-language Programming (NLP), AI developers and data scientists. Along with increased demand for high technical skills, there is also the issue of finding rounded candidates with experience of applying skills to business problems or academic training in sales and business. Scaleup leaders when asked about potential technical skill gaps talked about the same -

“When someone’s asking you about a project about building a predictive model to be able to analyse this and that, it’s a whole new kettle of fish and you’ve got to find your talented data scientists. You’ve got to pay for those people and they’re incredibly expensive at the minute. Then you have to retain and sustain [maintain them] - and the good ones are being called on a weekly basis”.

“What universities should put in all these courses is more business-ready training, rather than pure academic... rather than pure tech. It’s about getting these students ready. So when they come to work, they understand the communication and the time pressures of working in project management, the agile project management that every software company uses; that they understand the requirements of being a developer.” (VR Scaleup)

In short, many scaleups are looking at the education system to help provide a potent combination of STEM skills and commercial acumen.

A closer alignment between education and scaling businesses would be of mutual benefit, as it would also help to meet the talent demands of scaleups. This closer connection has been called for by the recent Kalifa report, “*Across further education and higher education, there needs to be much stronger alignment with the economic and societal needs of the nation.*”

It will be essential to continue to foster greater levels of collaboration between industry, colleges, universities and business schools in order to achieve this integration.

Achieving such a result requires scaling up of careers hubs and work encounters and platforms that can ease the connection of students to the workplace as explored further below.<sup>30</sup> This will link students with scaleup employers to facilitate internships and work experience, where Digital, Computing and Technology skills will be put to practical use.<sup>31</sup> **A key consideration in the design of the UK National Academy should be the way in which it can play a key role in this coordination and facilitation. In addition the Local Skills Improvement Plans must fully embrace and take account of their scaling business community and their needs.**

### Expanding Career Hubs

Such partnership between industry and schools can be facilitated by **the continued rollout of Careers Hubs, overseen by the Careers and Enterprise Company**, as proposed in Skills for Jobs White Paper. These Hubs are built on dynamic partnerships of schools, colleges, enterprise partnerships and local authorities working with local employers. They provide young people with the opportunity to connect closely to local skills and economic needs.

The recent expansion of Careers Hubs means that more than 65% of state sector schools and colleges are now participating.

It will be valuable to learn lessons from **Careers Hub Incubation Projects (HIPs)** that are designed to test *what works* in careers education, using the Careers Hub model. One example is the **HIP in Lancashire**:

The HIP Lancashire initiative aims to increase interest in digital careers and take up GCSE science by girls with the ultimate purpose of boosting the number of young females entering the digital workforce. Called Digital Futures, it will focus on digital careers interventions with Year 8 girls, amplified with teacher CPD, to test whether this increases GCSE Computer Science uptake by girls in secondary schools in Lancashire. Eight Lancashire schools are taking part, having been identified as having high quality GCSE Computer Science provision but low take-up by girls. The project will deliver high quality, locally tailored Digital/STEM related careers activities at varying intensities. It will be tracked by input type, intensity (how much each girl receives) and cohort to identify which blend of activity has the greatest impact for each cohort.

30 One option is to look at a “digital brokerage service” not limited to Fintechs, as suggested by the Kalifa Report, but across all scaling sectors. <https://www.gov.uk/government/publications/the-kalifa-review-of-uk-fintech>

31 <https://www.gov.uk/government/publications/the-kalifa-review-of-uk-fintech>

32 Baker Clause was introduced as an amendment to the Technical and Further Education Act 2017, the Baker Clause stipulates that schools must allow colleges and training providers access to every student in years 8-13 to discuss non-academic routes that are available to them.

In connecting young people with the world of employment, **the work of the Careers & Enterprise Company** has been crucial and **merits continuation and expansion**. 3.3 million young people are now regularly engaging with employers – a substantial improvement on five years ago. Existing private and third sector programmes, like [F4S](#), digital brokerage services like [Multiverse](#), [Speakers for Schools](#), [Workfinder](#), and [Springpod](#), all can be leveraged further to remove friction and costs, and more easily connect students and scaling employers.

While this progress is encouraging, there is still more that can be done. **Careers Hubs should be rapidly expanded to reach full coverage in the coming year**. These hubs and platforms can provide the kind of local brokerage service necessary for engaging with fast growing entrepreneurial business, as well as more established firms. This will provide students greater exposure to the range of skills and experiences available across the world of work.

### Employer Encounter Targets

Students need to experience work placements as standard throughout their further and higher education. Writing in March 2020, Ofsted emphasised that while inspectors are focusing much more on the opportunities for pupils to interact with external providers and employers beyond work experience, it is still the case that often this guidance starts too late.

**We recommend that targets for employer encounters, focused on Real World Learning, should be more ambitious and raised to three per year (one per term)** and more connection with scaling firms be a key objective. Encounters can occur through “remote” online channels, but must provide a meaningful project-based encounter.<sup>32</sup>

Work experience embracing Real World Learning, project-based learning or learning by doing provides clear examples of how children can be immersed in the fast pace of technological advancements, which affect almost every aspect of the job market. These interactions, including having companies present to students and provide project activities, are highly beneficial to pupils, as they allow for a better understanding of the subject and the range of roles available to drive wider interest beyond even more formal Computer Science roles.

Encounters can be further facilitated as highlighted above through Careers Hubs and platforms. This requires that scaleups be connected to these and that efforts are made to align these to the scaleup community as well as broader initiatives.

### Digital internships

This increase in meaningful school age work experience has the potential to take advantage of the current trend in **Digital Internships**. These could provide the possibility to overcome



traditional geographic barriers that separate children from internship opportunities as well as broader divides which can be experienced by children from disadvantaged wards or from BAME backgrounds.

The Lloyds Essential Digital Skills Report 2021 indicates that Ethnic Minorities are more likely to have Foundation Level digital skills than the UK average, 90% as compared to 81%.<sup>33</sup> More than one in six (15%) of the digital tech workforce in the UK are from BAME backgrounds which is proportionally 2% higher than the average across the total UK workforce.<sup>34</sup> However, it is important to ensure children from all backgrounds have access to appropriate opportunities to apply these in the world of work as part of their education with regional factors evident in relation to placements and internships.

**A remote form of work experience could therefore remove some of the place-based challenges,** allowing children to gain valuable experience at a reduced cost on a more equitable footing. Though these developments are still in their infancy, there is also the potential to build upon them by providing **digital mentors for older students,** which could support their decision making and also, if the mentors are from STEM/Computer science backgrounds, broaden the students' horizons.<sup>35</sup>

As mentioned above, using and building on existing private and third sector programmes, like **F4S**, and tracking the impact of employer encounters is vital. We have noted that there has been some progress in enabling access to the National Pupil Database through the Secure Data Service, which is a positive step.

The role of **Careers Leaders** in schools is also important. Further investment in training for careers leaders has been proposed which should include expanding their knowledge and understanding of the skills needs of scaleups and the opportunities they provide for pupils. **Teach First** is an example of such a programme; participants reported significant improvement in their knowledge or careers provision and available resources as a result of the programme.<sup>36</sup>

A further drive to build apprenticeship partnerships and build upon the Trainee schemes should be a key focus of government strategy to develop post-16 technical skills. The **Top 100 Apprenticeship** employers is an encouraging initiative, but it needs to be adjusted and enhanced to avoid the impression that large established companies, or public sector employers, are the only route to apprenticeships.

We believe that this listing should be based upon a relative

<sup>33</sup> p.20 [https://www.lloydsbank.com/assets/media/pdfs/banking\\_with\\_us/whats-happening/210923-lb-essential-digital-skills-2021-report.pdf](https://www.lloydsbank.com/assets/media/pdfs/banking_with_us/whats-happening/210923-lb-essential-digital-skills-2021-report.pdf)

<sup>34</sup> <https://technation.io/news/what-of-people-working-in-tech-are-from-bame-backgrounds/>

<sup>35</sup> It is worth noting that in order to reap the maximum benefit in achieving parity of opportunity, sufficient access needs to be guaranteed to digital equipment and suitable broadband for the most disadvantaged students.

<sup>36</sup> Evaluation of the second programme (2017/18) covering 43 schools from across the East Midlands, London and the South East/South Coast regions demonstrated positive results. 93% of schools involved now had a careers strategy and action plan and 94% had made progress against three or more Gatsby benchmarks while; almost half made progress against six or more. All participants reported significant improvement in their knowledge or careers provision and available resources as a result of the programme.

<sup>37</sup> <https://www.hrmagazine.co.uk/content/features/kickstart-scheme-six-months-on>

measure, such as growth rate, or split into categories that indicate the businesses that are providing the most dynamic and long-term routes to employment and skills. This will ensure that scaleups are better integrated into the scheme.

The Kickstart scheme has acted to connect our younger generation to job opportunities. While sound in concept and principle, if it is to be continued, it needs to be easy to access for scaleups and growth businesses to have the maximum impact. Initial limitations imposed on the minimum number of positions acted to reduce the ability of scaleups to engage in the scheme, yet despite initial teething problems it has been well received.<sup>37</sup>

**Collaborations between educators, businesses and government have never been more essential in order to resolve the UK skills crisis.** We need to accelerate this engagement and the models that enable it - building on what works as highlighted above (such as the Careers & Enterprise Company model) and growing impactful programmes. This will demand concerted effort and benefit from a joined up National Campaign.

The skills requirements of our scaleup businesses should be at the forefront of planning to safeguard future economic prosperity and that must be present in the planned future Local Skills Improvement Plans. We must continue to build stronger connections between educators and the scaleup business community, and further strengthen partnerships at a local level.

*“Careers Hubs are expanding across the country. Now working with more than 3,200 schools and colleges, and through them supporting their 2.5 million students, they are leading the way on improving careers education in England. Schools and colleges that are part of a Careers Hub deliver more support to students, have stronger links with local employers, offer more work experience opportunities and develop innovative ways of linking the curriculum with the different jobs a student could go on to do.”*

**Clare Hutchinson, Director of The Careers & Enterprise Company**

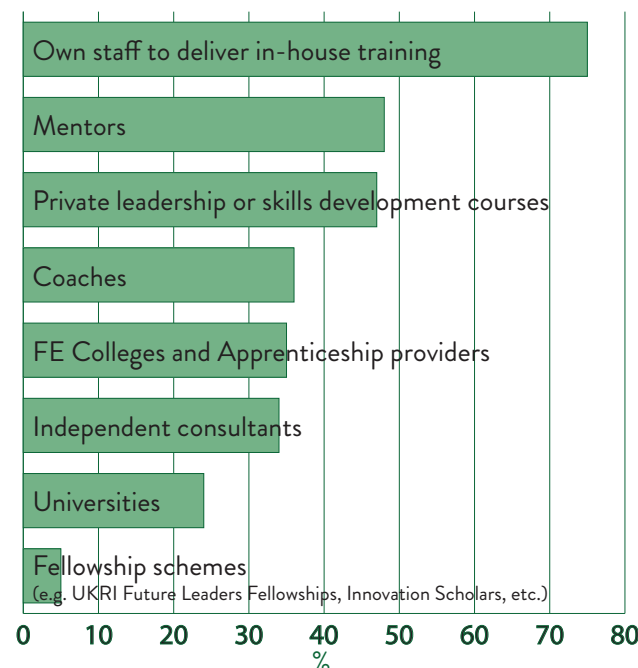
## Expand long-term initiatives to support lifelong learning and adult reskilling

While a strong educational framework at Key Stages 3 and 4 and more effective careers strategies are important, the role of lifelong learning cannot be overlooked in providing the skills for growing businesses. As highlighted in the [Skills for Jobs white paper](#), 80% of the workforce of 2030 are already in work today.

To meet the pressing needs of UK businesses, it is important to retrain people already in work to develop increasingly relevant technology skills today. The CBI estimates that 90% of the UK workforce will need to be reskilled by 2030.<sup>38</sup>

There is nothing to lose but everything to gain from making digital training available to all adults, regardless of their existing level of qualification. Individuals' value in the workplace would be enhanced while upgrading the nation's skills would give the UK a significant advantage in the global market.

Scaleups currently offer development to their staff through a variety of means; three-quarters (75%) offer in-house training delivered by other staff, half support staff with mentors (48%) and a significant minority look outside the business to private leadership/skills courses (47%), coaches (36%) and independent consultants delivering bespoke solutions (34%). There is also support from the education sector, whether that is universities (24%) or FE colleges (35%). However much more can be done to support learning, development and upskilling for staff in scaling businesses.



*“Government can play a role [in lifelong learning], they are an enabler, they are a convener, but as this report makes clear - the private sector's role in supporting lifelong learning and adult reskilling is absolutely critical. I engage with many, many technology companies both large and small - they're hungry for talent. There's 150,000 tech vacancies in the UK at the moment... Given this, what are we doing in the private sector to really drive this agenda, to encourage schools and to encourage people who are out in the workforce to go back and look at lifelong learning and retraining programmes to help them take on these jobs?”*

**Russ Shaw CBE, Founder, Tech London Advocates & Global Tech Advocates**

<sup>38</sup> <https://www.cbi.org.uk/articles/learning-for-life-funding-a-world-class-adult-education-system/>

One approach could be a “**computing reskill**”, aimed at anyone who either did not have the opportunity to learn technical skills or failed to take them up. Individuals who missed out could be encouraged to take courses, funded and trained.

[The Skills Toolkit](#) campaign is an essential plank for digital skills, which has been provided by the Government, and will need to be deployed in concert with the broader [Plan For Jobs](#) in order to maximise its effectiveness.

This encompasses both: the National Skills Fund, which was announced in September 2020 and provides free college level education to adults without an A-level or equivalent; and the Government’s £95 million commitment to its Lifetime Skills Guarantee, which it has recently announced will be expanded. This pays for adults who have not already achieved a Level 3 qualification to retrain in a number of areas, including technology. **As the UK National Academy is basing itself on the Open University, the role it plays in the delivery of a remote digital, computing and technology skills education will be essential and a key aim.**

These areas have potential to move the needle on digital skills, if they are able to act in a mutually cohesive way. Each will require sustained activity to meet the level of reskilling required from the UK workforce and community learning.

**Institutes of Technology (IoTs), will be vital to the success of re-skilling demands.** The recent decision to almost double their number in England from 12 to 21 is a welcome recognition of the importance they play. This needs to be combined with the expansion of **Digital Skills Bootcamps**, which build on successful pilots in Greater Manchester and the West Midlands, as well as looking to support initiatives that seek to provide small businesses with essential digital skills (such as the free mentoring provided by **Digital Boost**).

Opportunity must be open to everyone. Teachers looking for new challenges, for example, could retrain in digital to enhance their existing skillsets and be fast-tracked back into the classroom once qualified. This could reduce the worrying dearth of Computer Science practitioners.

**Flexibility is key to success.** There must be a range of options available to those in need of upskilling, with delivery offered both in person and online. Programmes

should include short, medium and long-term courses, boot camps as well as evening classes. It is also essential that these programmes reach all areas of the country to ensure that future skills, which are consistently in demand by scaleup businesses, are available in every community.

The 2021 Lloyds Essential Digital Skills Report records that the level of Foundation Level skills across the UK is not evenly distributed with areas such as Wales falling behind the rest of the country.<sup>39</sup>

Such initiatives can play a part in creating an active learning culture in the UK. They present a real opportunity to create a step change in attitudes encouraging individuals to continue to develop their skills throughout their whole working lives. This would help to develop a robust national skills base for economic growth in a fast-changing world.

*“The UK faces both a digital skills crisis and opportunity. If the Government sets the priority for digital skills in education and companies collaborate with schools to deliver then we can emerge out of this crisis with an advantage.”*

**Robert Newry, CEO & Co-Founder, Arctic Shores**

## Making it work: The Joined-Up Opportunity

### We need combined education, academic & industry partnerships

We recognise that this report comes at a time when the problems faced by the education system have been greatly magnified by the pandemic. However, the time of greatest stress can also be the best time for radical change. The recommendations we make are designed to create a societal shift that recognises digital, computing and technology skills are critical to our ever-changing world.

Educators will need support from both public and private sectors to bring that about.

For school leavers and graduates of higher and further education, the challenge is to ensure they are given the opportunity to gain the fundamental digital, computing and technology skills necessary for the evolving workplace. For adults, the need is to keep open the wide range of opportunities available by providing easy access to this fundamental knowledge and reskilling.

No one player working alone can achieve the skill shift needed.

The urgent requirement to develop a deeper and sustainable workforce pool with digital, computing and technology skills calls for - more than ever before - a combination of industry, education, academia and

public sector working as one to support the education process.

It means enhancing joint industry and education teaching forums and opportunities, providing enhanced access to work placements and joint development of teaching curricula.

The public and private sector are working on many excellent initiatives. There are many national and local initiatives in the UK doing great work through code clubs, business partnerships, work experience and placements. However, they are often undersized and not always connected.

Initiatives need to be even better “joined-up” and carefully coordinated. An inventory should be taken to measure their impact so far, using this information to decide where additional resources can be focused to most effectively scale up activity that is impactful. It is important to build upon what is working to ensure that solutions delivering impact can reach all areas of the UK.

Increased interconnectivity between education, academia and industry will be fundamental to enabling a truly digitally and technologically savvy.

The provision of effective careers advice is critical. Careers leaders and advisers need to focus on the skills needs of businesses, including scaleups, to enable them to grow and prosper.

*“We know the pandemic has impacted on the wellbeing and perceived lack of opportunities for the younger generation. It is vital for all of us to prioritise young people’s education and inspire young adults from all backgrounds providing the right support and technical skills, to break down perceived barriers and instill belief. We welcome the Levelling Up through Digital, Computing and Technology Skills paper recommendations and the call for collaboration – it is essential that we all work together so the next generation are more positive about their futures.”*

**Julie Baker, Head of Enterprise, NatWest Group**

<sup>39</sup> London (84%), South East (83%), East Midlands (82%) and North East (82%) are slightly ahead of the UK average (81%). Wales continues to have the lowest proportion of adults with basic digital ability (73%) [https://www.lloydsbank.com/assets/media/pdfs/banking\\_with\\_us/whats-happening/210923-lb-essential-digital-skills-2021-report.pdf](https://www.lloydsbank.com/assets/media/pdfs/banking_with_us/whats-happening/210923-lb-essential-digital-skills-2021-report.pdf)



## In summary

The UK is not alone in facing a technical skills crisis - it is part of a larger international trend. However, the UK is behind many other countries in preparing to meet this crisis. The Coursera Global Skills Report places the UK 47th in the world for technology skills, 77th for business skills and 34th for data science.<sup>40</sup>

The race is therefore on to meet this challenge. The countries that secure the prize of making education fit for purpose in the modern world will fundamentally prosper. Those that do not, face the risk of becoming client states in technology, outsourcing work and profit to those that do.

The first step to closing the technology gap is to accept that this is a national imperative. The digital skills associated with technology and computing are firmly established as vital to the fabric of society, of business, and their influence and the opportunity they provide will only continue to grow.

In this new and challenging decade, exacerbated by the turbulence of a global pandemic, a talent strategy that embraces digital, computing and technology will be indispensable for a prosperous future.

Government, educators, academia and industry must work as one on the common goal of providing the skills our future and current workforce must have for today's needs and the opportunities and roles of tomorrow. They also need to work together in campaigning to foster the recognition of the value of Digital, Computing and Technology skills across all generations and areas of the country.

Getting our UK Talent Strategy right across the entire spectrum - from school to industry - leveraging work experience, internships, employer encounters, apprenticeships and lifelong learning - will support the growth of our economy and scaleup opportunities.

Achieving success begins at the earliest school age, teaching

digital, computing and technology with a clear recognition that digital, computing and technology skills have become a critical language of the modern era. Most specifically, progress lies in raising the status of Computing Science by mandating a formal examination either at GCSE level or at the minimum introducing a compulsory accreditation.

Action is required to boost and accelerate Careers Strategies and Advice, work experience, employer encounters, and work placements, giving young people exposure to the technical skills that will be essential to the new industrial revolution. Careers Leaders and advisers, which should be further invested in, need to focus on the skills needs of businesses, including scaleups, to enable them to grow and prosper.

Initiatives such as University Technical Colleges (UTC), Institutes of Technology (IoT), Further Education colleges, Careers Hubs, and the National Centre for Computing Education will play a key role and must be sustained. In these transformational times, we also need to consider how we further augment classroom teaching with imaginative solutions and further evolve "flipping the classroom".<sup>41</sup>

Going forward the newly announced National Academy has a vital role to play and its evolution must be grounded in employer needs. Likewise the Local Skills Improvement Partnerships, should fully embrace and take account of their scaling business community and the skills needs of these growth companies as they drive local clusters and economic growth.

We recognise these recommendations come at a challenging time for the education system when it is facing ongoing pressure from intermittent lockdowns caused by the Covid-19 pandemic, with emerging variants and the processes to deal with them. However, the need for change is imperative to ensure that we equip young people with the skills needed for the modern and future work environment. Building on what works and upon the many skilled people in industry, who are already fostering

technical skills and workplace engagement, and continuing to involve the scaleup community in developing the curriculum will directly support the current and future job requirements of the scaleup economy. Taking this action will also drive local economic growth.

We also must not ignore the current workforce, 90% of which is estimated to need reskilling by 2030. To support them it is crucial to further expand Lifelong Learning.

No single actor can make this happen. Change demands a new partnership between educators, academia, industry and government that can produce an increased and more intensive collaboration. Only together can we achieve the goal of a fully employed, fully technology-enabled, vibrant and engaged workforce that can seize the opportunities the future - and scaleup - economy brings.

*"This paper is hugely encouraging, it has taken time to understand the Scottish situation and proposed a series of timely interventions. If these solutions are rolled out across the UK they should lead to significant changes in subjects offered at school and in further education as part of enabling access to the computer science skills we need across the whole country."*  
**Lucinda Bruce-Gardyne, Chair, Scottish Food & Drink**

## The Critical Priorities - key actions to take forward

### 1. Revolutionise the school curriculum to ensure that the status of Computer Science in schools is either compulsory examined or, as a minimum, has a clear accreditation level

Through:

- **Mandating** a requirement to undertake Computer Science at GCSE.
- Including a **compulsory** computer science module within all Mathematics assessment at GCSE;
- Creating a **Digital Accreditation** methodology for ALL - inclusive of A-level and graduate students

Encourage the expansion and the take up of **Braided Careers**

Expand at pace the **National Centre for Computing Education**

**Continue to embrace alternatives to traditional schooling methods**, including exploring greater usage of the "flipped classroom" ; model and practical skills focused qualifications provided by the "T-level" and Institutes of Technology (IoT). Development of new teaching academies / techniques should not be unduly hampered by unnecessary 'red tape'.

Consider the role of the newly announced **National Academy** in Accreditation and Examination schemes and in connecting the private and education sector together and coordinating in on place the routes to access a Digital, Computing and Technology expertise / qualification.

### 2. Inspire Students to see the breadth of career opportunities within their reach that Digital, Computing and Tech skills can Unlock

Education and employers must embrace each other to provide more work experience, internships and options for apprenticeships.

Increase **Employer Encounters** to 3 per year -one per term

**Expand grant opportunities** to support employers taking on trainees /work placements etc. Expand Digital Internships and opportunities for remote work experience.

Scaleup **Careers Hubs** and ensure they cover the whole country by 2023

Enhance **Digital Mentorship** of older students by leveraging such programmes as Digital Boost

Invest more in **Careers Leaders** in Schools and programmes such as Teach First.

**Local Skills Improvement Plans** should fully embrace and take account of their scaling business community and their skills needs and showcase opportunities in the local scaleup economy. SUI, private and public sector should ensure continued mapping and identification of such businesses and showcase job opportunities / roles

Launch a coordinated public/private **National Campaign** to Raise the recognition of the value of Digital, Computing and Technology skills including role models and broad communications channels and platforms.

### 3. Expand long-term initiatives to support lifelong learning and adult reskilling

Continue to evolve, expand and enhance awareness of the **National Skills Fund**, the **Lifetime Skills Guarantee** and **Institutes of Technology**.

Expand **Digital Skills Bootcamp** and continue the mentoring provided by **Digital Boost** - ensuring these opportunities are open to everyone, including Teachers.

**Build on What Works and Join Up initiatives where appropriate** - the Digital Skills Ladder, An inventory should be made and impact assessed so far. to decide where additional resources can be focussed to most effectively scale up activity that is producing tangible and meaningful results.

Ensure the newly announced **National Academy** plays a pivotal role in this area and in the signposting and co-ordination of private and public sector initiatives.

<sup>40</sup> Coursera global skills report 2021 <https://pages.coursera-for-business.org/rs/748-MIV-116/images/coursera-global-skills-report-2021.pdf>

<sup>41</sup> "Flipping the classroom" is a teaching technique in which students gain first exposure to new material outside of class, usually via reading or lecture videos, and then use class time to do the harder work of assimilating that knowledge, perhaps through problem-solving, discussion, or debates. Source: <https://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/>

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*“This report shows clearly that we have to encourage schools to take this subject a lot more seriously - it’s not about whether, it’s about how.”*

**Dermot Turing, Author, Lawyer & Trustee of The Turing Trust**





```
mirror_mod = modifier_ob.  
set mirror object to mirror  
mirror_mod.mirror_object  
operation == "MIRROR_X":  
mirror_mod.use_x = True  
mirror_mod.use_y = False  
mirror_mod.use_z = False  
operation == "MIRROR_Y":  
mirror_mod.use_x = False  
mirror_mod.use_y = True  
mirror_mod.use_z = False  
operation == "MIRROR_Z":  
mirror_mod.use_x = False  
mirror_mod.use_y = False  
mirror_mod.use_z = True
```

```
+y+2a)-(3a+3g+x)  
5+x+k+2a+21  
E=mc2  
text.scene.objects.active  
"Selected" + str(modifier  
mirror_ob.select= 1  
modifier_ob.select=1  
mirror_ob.select= 0  
bpy.context.selected_object  
data.objects[one.name].select
```

```
1+x+y+2a  
1+x+y+2a  
1+x+y+2a  
2+...+2a+...+a  
print("please select exactly  
OPERATOR CLASSES  
45-4a-3  
{x-12-y+n...}
```

```
types.Operator):  
X mirror to the selected  
object.mirror_mirror_x"  
mirror X" (1+x+y+2a)-(3a+3g+x)  
context):  
context.active_object is not
```