The Case for General Information Technology Training

Dr Terry Critchley; 28th February 2025

There is a wide misunderstanding today about what constitutes workplace information technology (IT). Some sources, mainly academic, say that computer science (CS) fits the bill, others maintain that computing is all about coding and algorithms or PCs and Windows. Who is right? Well, it depends on what is meant by computing, bearing in mind Humpty Dumpty's maxim; '*When I say something it means exactly what I want it to mean, no more, no less*'.

If your business is designing and creating computer hardware and system (not application) software, CS may be just the ticket for you, although CS is acknowledged as being 'light' in soft skills, quite static and missing workplace context or 'where used'. If you are deeply involved in just one aspect of computing, such as artificial intelligence (AI) or machine learning (ML), then coding and algorithms skills may well suit this need. See later in this document for some of the drawbacks of this stance.

My maxim in this article is that computing is that arrangement of people, processes and technology which aids and enhances the workplace in carrying out its business, whatever that may be. My aim is to show exhaustedly that current training does not fit the skills needed in the modern workplace and to propose what might be done solve the problem.

NOTE: This paper is not an organised and logical treatise on the need for broad, general IT training but the presentation of a series of aspects of this topic, supported by relevant links to other material.

The result, I believe, is conclusive proof of my general IT knowledge thesis.

This is the final public version of this document although I will update it for personal use or to put down any doubting Thomases.

My Thesis Up Front

Anyone who thinks that getting a degree in CS or other 'IT' will see them through until retirement in *workplace* computing is deluding themselves. The only constant thing in computing is change and if you and your training don't change with it, you perish or are demoted to cleaning machine rooms or worse.

As Charles Darwin said; '*It is not the strongest of the species that survives, nor the most intelligent, but the one most adaptable to change.*'

The outstanding need in IT today is the availability of phased, general IT training with specialist exit & entry points for skills update and exit points to other courses or a sojourn of some sort – apprenticeship - with a company. It must also be capable of change as business and technology change, manifesting itself as an evolving part of lifelong learning.

This type of training, coupled with a commitment to lifelong learning, underpins a career in IT and allows the incumbent to ride the waves of business and the associated technology change plus being a launching pad for various specialisations. Such training does not exist today, hence the current 70% failure rate of IT projects.

Information Technology is, and has been, evolving rapidly and accounts for job mutation. AI has now created a tectonic shift in IT skills and roles so that static and/or off-beam training will do little to help mitigate the IT skill shortage. An evolving foundation IT knowledge, covering the full IT terrain, together with career-long upskilling is the only real solution.

The days of Willie and Wendy Oneskill are well and truly over and Darwinian 'adaptability' is the keyword of Modern IT.

Contents

The Computing Workplace

Failure Seems to be the Norm

If you work for a company, large or small, which deals with selling goods and services to clients, then you will need to be an 'IT Decathlete' for reasons which will become clear.

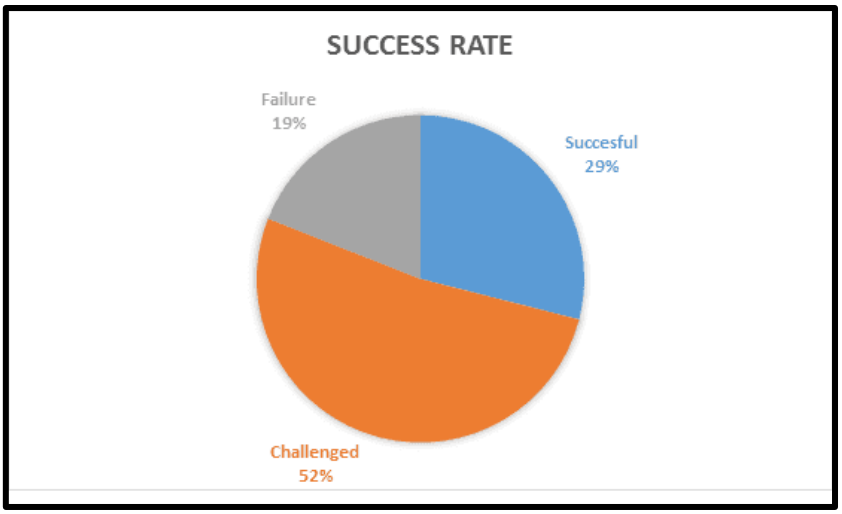
What I list below deserves the words of a pop song: '*When will they ever learn, when will they ever learn*!'[1]

Firstly, let us look at the constituents of the computing *ecosphere*;

1. Business requirements of many kinds
2. People with appropriate skills; general, specific and soft to satisfy these requirements
3. Processes; ways of doing things in IT. This really means tools and techniques outside hardware and software which facilitate getting things done. Examples are business specifications, project definitions and project management. They are not options if a computer project is to succeed, a fact forgotten by many in the technology rush to *digitise* everything that moves.
   It is the development of new business processes which is the crux of *digital transformation (DT),* not the acquisition of wagonloads of technology to use on the old processes. Some 70% of DT projects fail according to various sources, with roughly the same %age of budget squandered as a result.
   'In fact, one study (*) of 825 global business leaders found that 70% of digital transformations(opens new window) do not reach their objectives due to digital skills gaps.' [source below (*)]

(*) Flipping the Odds of Digital Transformation Success
https://www.bcg.com/publications/2020/increasing-odds-of-success-in-digital-transformation

And next, yet another study backing up the development '70% failure' rates.



LEGEND **Failure 19% Succesful [*sic*] 29% Challenged 52%:**

[1] *Where Have All the Flowers Gone*: Song by The Kingston Trio

.. and one more for the road!

‘ “When I joined KLM, we were facing problems and errors in over **70%** of all software deployments’. [my boldening]

Air France-KLM Speeds Up Java Application Deployment with Digital.ai Deploy

https://digital.ai/resource-center/case-studies/air-france-klm-speeds-up-java-application-deployment-with-digital-ai-deploy/

.. and to add to your tedium;

‘Change is the most crucial and hardest aspect of any transformation. Approximately 75% of change efforts flop -- either failing to deliver the anticipated benefits or being abandoned entirely’.

Digital Transformation: Signs of Doom and How to Fix it
https://www.informationweek.com/strategic-cio/digital-transformation-signs-of-doom-and-how-to-fix-it-

5 Reasons Why Software Development Projects Fail
https://cloudindustryforum.org/5-reasons-why-software-development-projects-fail/

Modernisation of applications and their IT surroundings do not escape this fate.

‘Delving further into the responses of each category, architects respond in an enlightening way with “too complex,” “inadequate skills or training,” and “failure to accurately set expectations” all tied for the 2nd most common reason for failure. ‘

Why App Modernization Projects Fail [79%]
https://vfunction.com/resources/report-wakefield-why-app-modernization-projects-fail

‘Making the decision to transform digitally is the easy part of the equation. Around 70% of transformations fail (*) — and they are only getting worse. This is hugely significant, considering that most CEOs see digital transformation (DX) as a critical growth driver.....

According to Gartner research, 89% of board directors say digital business is now embedded in all business growth strategies.’
(*) https://www.mckinsey.com/capabilities/transformation/our-insights/perspectives-on-transformation

What does it take to make your digital transformation succeed?
https://blog.softwareag.com/what-does-it-take-to-make-your-digital-transformation-succeed

Employee digital upskilling: Why it matters now more than ever
https://www.multiverse.io/en-US/blog/employee-digital-upskilling-why-it-matters-now-more-than-ever

‘The results underscore the difficulty: in 2018, **McKinsey** reported that the success rate for large-scale digital transformations was below 30 percent.’

A time to modernize
https://blog.microfocus.com/a-time-to-modernize/

‘ Investment in *digital transformation* is expected to approach $6.8 trillion between 2020 and 2023 as the world economy digitises. Yet the vast majority of these investments stall or fail - and usually for reasons within a company’s

control. To make the most of the digital opportunity, it is not enough to want to transform, businesses must have the right leadership in place and properly resource projects. '

Business Transformation - Raconteur, 31st March 2021

Below I give an example (of many) UK public sector failed IT projects. I am sure that there were probably sufficient pure technology skills available but I suspect their ability to design, plan and implement such a project was *sub-optimal*.

NAO hits out at Home Office for law enforcement data service failures
https://www.publictechnology.net/articles/news/nao-hits-out-home-office-law-enforcement-data-service-failures

'Now more than ever, continuous upskilling and reskilling within IT is a requirement'.

How much easier would this be if each IT person had a solid background in general IT? How might a person move from, for example, cybersecurity to Cloud Consultant without this general platform?

Masters of our own learning universe [RACONTEUR, 12th September, 2017]
https://www.raconteur.net/digital/digital-is-making-students-masters-of-their-own-learning-universe/

'Most Critical Workforce Skills

- Basic computer and software/application skills
  My thesis, alpha and omega
- Technical core STEM capabilities
- Ability to communicate in a business context
  Not often the preserve of geeks
- Willing to be flexible and adaptable to change
  To cater for job mutation, appearance and disappearance
- Ability to work effectively in team environments
  Difficult if you don't know what the others are talking about
- Fundamental core capabilities (reading, writing, arithmetic)
- STEM science, technology, engineering and mathematics.' [Source IBM]

https://www.raconteur.net/special-reports-archive/ for many similar reports

Upskilling IT 2023 Report [DevOps Institute]

https://www.devopsinstitute.com/upskilling-it/

4. Hardware and software, the technology; configured and used to put the business requirements onto a computer system. Items 2-4 comprise the IT version of the general maxim that you need people, processes and products (the 3Ps) to get things done in computing.
5. Other skills such as communication, writing, ability to make complex things simple to understand by lesser mortals and so on; these are lumped under the heading of 'soft skills'.
   Companies that put 4. before 3. in their DT efforts are the main project, and possibly job, casualties.

The Workplace Characteristics

Secondly, let us look at the workplace characteristics of this computing ecosphere;

1. It is fast moving, even in traditionally slow, unchanging environments like banking and insurance.
2. It is driven by profit, the need to compete (or stay in business) and coping with ever-present change, both in business, governance and the 'market' needs.
3. The increased dependence of business on technology brings extra needs, such as high availability and disaster recovery. Without computing many businesses would cease to function, other severely hampered.
4. The technology available changes rapidly too, both in quality and quantity (larger storage faster networks, different configurations – containers for example - etc.) A word of caution: you don't necessarily need the *latest and greatest* technology to implement business change.
5. The jobs in IT mutate, just like a virus, and the received opinion is that the half-life of a job in its current form is 18-30 months, after which it is a different 'shape and size' or even species.

   'In the past, technical skills were relevant for 10 or more years before they needed refreshing, but today the majority of technical 3 From Bootcamps to Digital Badges: How to Effectively Develop Mainframe Skills D 4 How Open Source Bolsters Power Systems Modernization and Hybrid Cloud Strategies skills have a half-life of about 2.5 years requiring a continuous reskilling effort and readily available training, according to Surch.' [link below p.3]

From Bootcamps to Digital Badges: How to Effectively Develop Mainframe Skills
https://techchannel.com/Admin/IBM/media/PDFs/TechChannel_ebook_Enterprise_July-2021.pdf

'Information technology (IT) systems are the glue that holds modern enterprises together. They power internal systems, are often critical market differentiators, and need to deliver ever-improving functionality for customers, employees, and partners. At the same time, system complexity and speed of change have escalated: deployments routinely span multiple on-premise and cloud locations, an array of software technologies are used, and the teams behind these systems can vary greatly in their skills. The increased focus on digital transformation highlights the business advantages of change, but often does not address how to deliver real value with new technologies.'

Hybrid Cloud
https://www.redhat.com/rhdc/managed-files/mi-cloud-native-meets-hybrid-cloud-ebook-f30835-202202-en.pdf

'In 2021, 94% of IT professionals agreed that their roles and responsibilities have moved away from simply provisioning IT equipment and are now focused on providing solutions that promote employee collaboration and productivity. This research highlights that only 40 percent of an IT professional's day is spent on "keeping the lights on" – software upgrades, troubleshooting requests, etc. The rest of their day is spent developing larger organizational strategies and employee experience tasks.'

CIOs beware: IT teams are changing
https://enterprisersproject.com/article/2022/11/cios-beware-it-teams-changing

‘According to a recent CIO survey conducted by KPMG(*), the technology skills shortage is greater than it’s been since 2008. The lack of specific skills in areas deemed critical to future growth—like data analysts, AI experts, and cybersecurity specialists—is acute.

Tech Skills Gap Versus Tech Skills Shortage
https://www.td.org/insights/tech-skills-gap-versus-tech-skills-shortage

(*) https://www.hnkpmgciosurvey.com/ [link]

> ‘Skills gaps remain costly. According to PwC, the talent shortage and skill gaps in the U.S. alone is expected to cost $8.5 trillion by 2030. .....
>
> The barriers to upskilling or skills development remain the same. The top three barriers to upskilling are lack of time (44%), lack of budget (40%), and making upskilling a priority (30%). ....
>
> Additionally, many see a ` lack of upskilling offerings’ as a barrier. When we asked what the current barriers to upskilling are in 2022, 29% said that the lack of offerings (in terms of content, topic, or depth) is perceived as a barrier.’

Upskilling IT Report 2023

https://www.devopsinstitute.com/upskilling-it/

> ‘Uppal said: "Despite the digital skills gap discussion persisting for over a decade, UK organisations are still failing to sufficiently upskill employees, and it is directly impacting business and wider economic growth. This is because we have not come to a shared understanding of what the skills gap is or what digital skills means - this needs to be done to move forward and close the gap.
>
> "In the next three years, AND Digital estimates the UK workforce will require eight million individuals proficient in digital skills to close the gap.‘

Digital skills shortage hampering UK business growth [5 October 2022]
https://www.computing.co.uk/news/4057452/digital-skills-shortage-hampering-uk-business-growth

Digital Leadership Report 2021
https://uploads-ssl.webflow.com/5da4969031ca1beeb3e008e0/618b9075b55f782b954c3d27_FinalHNGDigitalLeadershipReport.pdf [report]

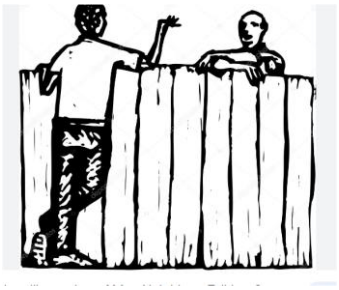
> Some jobs disappear; some say that half (or more) the jobs which will be around in 5 - 10 years do not exist today.
> So much for static learning. IT learning is a lifelong activity, like breathing; if you don’t do it you die, metaphorically speaking. Others do not die but become moribund, even trendy new ones; how can that be? Well, such posts cost money and in most cases, some executive will look at these costs and ask ‘*what they are doing for my bottom line (profit)*’. If a satisfactory numeric answer is not forthcoming, the job goes. I know, because I’ve seen it happen.
> Lifelong learning can have a beneficial effect on mental and physical well-being as well as job satisfaction and career progression.

What are the wider benefits of learning across the life course?
https://dera.ioe.ac.uk/29773/1/Skills_and_lifelong_learning_-_the_benefits_of_adult_learning_-_schuller_-_final.pdf

> ‘This question was raised by Google's Steve McGhee, who contributed to the SRE Report. "One interpretation," he says, "is that Execs are looking at the bigger picture, and ICs are focusing on a smaller portion, missing the context. That's certainly the traditional (Taylorist) model employed at many Enterprises today, but we can do better. By providing transparency, context, and rationale around budgets, revenue and loss, teams can better understand trade-offs made "above them" instead of simply throwing POs up to management to see what sticks." ‘

Bridging the Gap Between Executives and Individual Practitioners
https://www.apmdigest.com/sre-site-reliability-engineer-report-2023

Moral: Both sides of the executive/practitioner divide to need to have the ability to talk to each other across the fence which divides them for the good of the company and its customers.



The uptick of this latter discussion is that because if business’ dependence on functioning IT, both sides of this ecosphere need to understand enough of the other side’s section of the business for success.

Remember, it takes two to tango and this principle holds true in business.

My Thesis Up Front

Anyone who thinks that getting a degree in CS or other ‘IT’ will see them through until retirement in *workplace* computing is deluding themselves. The only constant thing in computing is change and if you and your training don’t change with it, you perish or are demoted to cleaning machine rooms or worse. The outstanding need in IT today is the availability of phased, general IT training with specialist exit & entry points for skills update and exit points to other courses or a sojourn of some sort with a company. It must also be capable of change as business and technology change, manifesting itself as part of lifelong training.

This type of training, coupled with a commitment to lifelong learning, underpins a career in IT and allows the incumbent to ride the waves of business and the associated technology change plus being a launching pad for various specialisations. Such training does not exist today, hence the current standstill.

IT is, and has been, evolving rapidly and accounts for job mutation; AI has now created a tectonic shift in IT skills and roles so that static and/or off-beam training will do little to help mitigate the IT skill shortage. An evolving foundation IT knowledge, together with career-long upskilling is he only real solution.

Summary: Today's Training Falls Short

I feel, and after much research, that the computing training on offer today falls short of what the modern workplace is using and the newer computing areas emerging it is entering in what is called 'digital transformation'. In short, the reasons for my statement are:

1. 70% of UK IT projects fail in ways from '*not quite what we wanted'* to '*total failure'*.
2. Current school and university computer training is overwhelmingly based on computer science (CS).
   This forms the main area for feeding IT with the skills it needs. This is far too narrow and any IT training needs to appeal to other parts of society who cannot go to school or university.
3. CS is very theoretical, lacks workplace context (the '*so what*' or '*where used*' test), lacks wide appeal and, in my view is quite soulless. A survey of mine, carried out by CAS (Computing at School 2018) on reasons females did not take to CS education yielded several reasons. Prominent were '*It's boring'* and '*needs too much maths*'. Neither of these gripes apply to the IT education I am suggesting nor are they true of the IT world I still inhabit, albeit virtually and not at the coal face.
4. In addition to 3. above, many CS curricula appear to be a disparate set of topics and there is no overarching structure, representing IT as an entity, is visible. It is rather like being taught the details of all the components of a motor car but remaining unable to visualise the complete vehicle, its purpose, how to find one's way around in it by reading a map and knowing that it needs fuel and servicing and the all rest.
   Another analogy (for the still unconvinced) CS is like being taught how to operate and steer a particular ship but have little idea about seamanship, navigation and other aspects of sailing the high seas in all weather
   How did I reach this decision? In several ways; industry is volatile and education to match its need must be equally fluid. Computer Science courses are, in relative terms, static and lack logical flow and fail to reflect the synergy between the steps in any IT project. Many are in essence a list of well-presented technical topics, most of which fail the 'flow' and the previously mentioned '*So what?*' and '*where used*' tests.
5. CS fails to cover the topics which define good information technology (IT); area such as SLAs (service level agreements), high availability (HA), performance, cybersecurity practice and others similar important topics – all vital to successful IT usage – are ignored or given short shrift. In addition, the flow of IT projects, from business need, through specification and a dozen other steps to implementation. The car analogy above is useful here.
   I can illustrate this point further with reference to a Western film, *Catlow* (1971). It is a series of very interesting segments with a distinguished cast but I lost the plot after half an hour as I could not relate the segments to a destination (advertised culmination) of the plot.
6. Number qualifying with computer skills are falling, as the report below tells us.

40% drop in British students leaving school with an IT qualification will exacerbate future digital skills gap
https://www.intelligentcio.com/eu/2020/10/28/40-drop-in-british-students-leaving-school-with-an-it-qualification-will-exacerbate-future-digital-skills-gap/

7. In IT, without wide underpinning knowledge, it will be difficult for a person to survive in what is a *team game*, not collection of individuals with different skills (topic-loners), all acting independently. Each team member will be expected to have some knowledge, however limited, of the other members' areas of expertise.
8. Many people are coming to the conclusion that a degree is not necessarily the only way to get a good job in IT. My own belief, held for some years, is that a computing degree or other high-level qualification will probably get you an interview but your acceptance will depend on the actual interview performance.

Getting the degree was the easy bit
Life for graduates is increasingly difficult and Billy MacInnes discovers that some are starting to wonder if it's not better to just get involved with the IT industry at the earliest opportunity
https://www.computerweekly.com/microscope/opinion/Getting-the-degree-was-the-easy-bit

Having said that, the problem of how to get a workplace-ready IT education without a degree remains but developing such education is perfectly feasible. I have produced a draft plan for such a project.

9. In addition, jobs in IT do not remain the same *ad infinitum*; they mutate into other forms and the *half-life* of a typical job is said to 24 months. Unless this wide, basic knowledge of pragmatic IT is acquired, it will be difficult for a person to survive this mutation. Without it, promotion, especially to management jobs, will be difficult.

10. Moreover, 68% of businesses reported that they find it challenging to hire digital workers, with 45% attributing this to a shortage of qualified applicants.

Our research exposed a gap between formal education and the working world, with 45% of businesses stating that candidates for entry-level positions often lack core technical skills despite holding a relevant degree, and 26% said they lack soft skills.

Our research also shows that those businesses preferring to hire candidates from leading universities face greater difficulties than those that don't adopt a more flexible approach. For example, whereas 26% of businesses that hire from the top-ranked universities struggle to find candidates with the necessary production support skills, this is true for only 13% of businesses that explore a wider talent pool. Across nine identified skill sets, businesses that recruit graduates from the top-ranked universities face less difficulty in only three skill areas: Data science: 36% vs 44%, Cyber: 44% vs 49%, and DevOps: 19% vs 21%.

'Equally, many Gen Z professionals could enter the job market believing that a computer science degree is enough to secure a role. As our findings demonstrate, not only is this not necessarily the case, but the importance

> attached to degrees beginning to fade. In fact, 53% of surveyed businesses are considering dropping the degree requirement from certain roles over the next year to open the door to more candidates who don't have the opportunity to go to university.'

https://www.wiley.com/edge/site/assets/files/1084/wiley-edge-2023-diversity-in-tech-report-uk.pdf

Job Mutation (or Loss)

Classic cases of job mutation, or even annihilation, are shown below.

The links below illustrates clearly the mutating nature of skills needed, not just in an IT role but in a broad swathe of an IT topic's knowledge.

> 'Businesses globally are embarking on *large-scale reskilling programs to reduce the potential impact of AI on the workforce.'*

AI tools could cut staff working hours by almost half
https://www.itpro.com/technology/artificial-intelligence/ai-tools-could-cut-staff-working-hours-by-almost-half?

The next link reinforces this message.

Tech giants know AI job losses are coming — here's how they plan to retrain the global workforce
https://www.itpro.com/business/careers-and-training/tech-giants-know-ai-job-losses-are-coming-heres-how-they-plan-to-retrain-the-global-workforce

> 'Entry-level workers increasingly fear job loss or significant changes to their careers due to automation made possible by generative AI (genAI). Nearly one-in-four "early career" employees (24%) believe their job could be replaced by automation, according to survey results from professional services firm Deloitte .'

Multicloud Skills Are Critical, But Lacking
https://www.apmdigest.com/multicloud-skills

[See: *State of Cloud 2023*
https://learn.pluralsight.com/resource/offers/2023/state-of-cloud]

> 'Nearly half (47%) of U.S.-based tech executives surveyed reported half or more of their cloud deployments will be supported by AI-driven applications in the next year, with nearly two-thirds (65%) saying they'll reach half or more by the end of 2023. '

Organizations Struggle with Cloud Complexity, Look to AI for Solutions [Mar. 29 2023]
https://www.itprotoday.com/cloud-computing-and-edge-computing/organizations-struggle-cloud-complexity-look-ai-solutions

> 'Yet, the need to reskill is so much greater. Research from Nesta indicates that as a result of technological progress and changing demographics, more than six million people in the UK are currently employed in occupations that are likely to change radically or disappear entirely by 2030, spelling a much larger need for transition on the horizon.'

The link below alludes to the personnel layoffs and, in tandem, undertaking additional hiring by tech companies big and small. Can this mean that the people being laid off cannot 'mutate' to other, much needed jobs? I suspect so.

How many jobs are available in technology in the US?
https://www.computerworld.com/article/3542681/how-many-jobs-are-available-in-technology.html

> 'CIOs need a technology workforce model that is resilient in the face of disruptive trends. Unfortunately, many organizations' current workforce models and talent practices are too static, rigid, and slow to keep pace with the demands for digital acceleration. Because of this, a resilient workforce model must be configured so that talent and work can be effectively aligned to respond to future business scenarios.'

How to Build a Resilient Technology Workforce Model
https://www.itprotoday.com/it-management/how-to-build-a-resilient-technology-workforce-model

The Need for General IT Knowledge

> 'The integration of AI in cybersecurity is not only transforming existing roles but also paving the way for entirely new job roles and specialisations. Both Tom and Jonathan offered insightful perspectives on the potential for AI to create novel career opportunities.'

Why You Should Learn AI In Cybersecurity
https://purplesec.us/learn/why-learn-ai-in-cybersecurity/

Job Mutation 2025 On

> '"Educating and upskilling the workforce, driving better collaboration between business units, and improving governance can all play a vital role in helping organizations move more effectively from technology trials into pervasive deployments," Baschnonga said. "For IT leaders, it is important to collaborate with other leadership roles and functions to build a combined perspective on the benefits of new technologies, while also developing more collaborative relationships with ICT suppliers."

The report points out that IT complexity is worsened by too many point solutions and that the actual implementation of much-hyped technologies where achievements are less than the hype are in:

- Integrating point solutions
- IoT
- Edge computing
- Gen AI

`Again, this is a clarion call for general, comprehensive IT education to iron out these cross- and integration-skill problem.`

Enterprise Tech Investments Rise While Deployments Lag, EY Study Finds [Feb. 20, 2025]
https://www.itprotoday.com/it-management/enterprise-tech-investments-rise-while-deployments-lag-ey-study-finds

> 'A new study from freelance hiring platform Upwork shows that 80% of executives prioritize skills over degrees when hiring, with half planning to boost freelance hiring this year to address gaps in AI and other skills. However, the skills needed, particularly for AI, are constantly evolving.'

Technology skills gap plagues industries, and upskilling is a moving target

https://www.computerworld.com/article/3814707/technology-skills-gap-plagues-industries-and-upskilling-is-a-moving-target.html

> 'Russ Shaw CBE, founder of Tech London Advocates and Global Tech Advocates .... He questions whether the higher education sector is equipping students with the skills that their future employers need....
> One factor behind this is the misalignment between what is taught in academic programmes and what the industry actually needs," Shaw says, "Graduates often emerge with theory but lack the practical, hands-on experience and up-to-date technical skills employers are looking for...
> Whilst Shaw clearly thinks that universities need to do more to prepare graduates for the world of work, he also thinks employers need to accept some responsibility for training....
> Employers need to take responsibility for investing in entry-level training schemes, internships, and apprenticeships to equip graduates with the experience they need. Meanwhile, academic institutions have a duty to align curricula more closely with industry needs." '

Employers are contributing more to the tech skills gap than they realise
https://www.computing.co.uk/feature/2025/employers-contributing-to-the-tech-skills-gap

`I could rest my case here but there is more support for my thesis from hereon in ….`

If the 'leaver' in the link below is in a role resembling a specialisation, their options for a new role are limited unless they have good grasp of general IT.

Nearly half of tech workers are seeking new roles [January 2025]
https://www.itpro.com/business/careers-and-training/nearly-half-of-tech-workers-are-seeking-new-roles-declining-employee-benefits-and-reduced-flexible-working-options-have-staff-looking-elsewhere

> 'But supporting a technology strategy that attempts to offset skills gaps by supplanting the need for those skills is also changing the fabric of IT careers — and the long-term prospects of those at risk of being automated out of work. To this end, we considered which skills could be rendered obsolete in the next few years, thanks to technical advances, and how IT pros can reinvent their skills offerings to avoid ending up with an IT career that's not long for this world.'

5 dead-end IT skills — and how to avoid becoming obsolete
https://www.cio.com/article/188985/6-dead-end-it-skills-and-how-to-avoid-becoming-obsolete.html

> 'Overall, the studies by ManpowerGroup, online hiring platform Indeed, and Deloitte Consulting showed that IT hiring will increasingly be based on having flexible skills that can meet changing demands. "Employers know a skilled and adaptable workforce is key to navigating transformation, and many are prioritizing hiring and retaining people with in-demand flexible skills that can flex to where demand sits," Prising said.'

What IT hiring looks like heading into 2025
https://www.computerworld.com/article/3623583/what-it-hiring-looks-like-heading-into-2025.html

> 'Gina Smith, an IDC research director, said CIOs will have to balance hiring people with 'the needed skills versus training current talent in new domains.
> "I am skeptical that the majority of companies will choose to upskill these people" because IT executives "are beholden to the bottom line," Smith said. "The rate of new technologies is rapidly accelerating. We can't keep them up to date because the requirements keep changing." '

2025 IT headcount expectations lowest in over a decade [04 Dec 2024]
https://www.cio.com/article/3616601/2025-it-headcount-expectations-lowest-in-over-a-decade.html

> 'It is also important to consider that the cyber security industry requires more than just information security skills, he says: "Core skills such as problem-solving, communication, and foundational IT expertise also have a key role to play in establishing well-rounded security teams".'

The cyber security skills shortage: What skills are missing?
https://www.itpro.com/security/the-cyber-security-skills-shortage-what-skills-are-missing

Don't Take My Word for It

Fast Forward for Digital Jobs [techUK]
https://www.techuk.org/shaping-policy/fast-forward-for-digital-jobs-report.html
https://www.techuk.org/asset/5A115863-8EFB-4F8C-9B52486240BB100A/

The same *topic sidestepping* applies to the mainframe in the CS (computer science) arena, a discourse on which I have already produced and can be made available on request. Given that this beast supports a huge part of modern business, especially finance, and is a good career, the absence of it from CS syllabuses is disingenuous and deprives the student of knowledge which can offer them a career path.

In similar fashion scientific, and often graphics, are given short shrift despite the fact that they form a large part of the workplace activity. High Performance Computing (HPC) is no longer the preserve of the mad, long-haired boffin but is used in bioscience, finance and business planning to an increasing extent.

- Server HPC and client graphics are used in synergistic combination too, for example, in molecular modelling.
- Denial of the existence of these two areas of computing is disingenuous and severely limits the career horizons of students.

> 'However, the sheer volume of training can be a barrier to developing digital skills in itself. Variations in style, relative value, quality, onward application, timescales to completion, longevity of qualification and cost make it difficult for the uninitiated to understand where to focus their time. In addition, there is often a disconnect

between training and an available role.' [Exactly what I have been saying for four years]

'There is a need to consolidate training material relevant to employment opportunities into a single structured platform, able to group and signpost material in a way that is meaningful and supports an end-to-end-digital journey.' [ditto]

Digital skills [from techUK]
Establishing a digital learning pathway - August 2020
https://www.techuk.org/resource-report/digital-skills-establishing-a-digital-learning-pathway.html [contains pdf document link see .pdf at end of this link]

Here we have the flavour of the month – cloud computing held up by – you guessed it – skills gap!

Cloud Adoption Will Fail Because of the Skills Gap
https://www.itprotoday.com/cloud-computing-and-edge-computing/cloud-adoption-will-fail-because-skills-gap

And even the 'big burners' which underpin the workplace are short of skilled people.

Data Center Skills Gap Creates Employment Shortage
https://www.datacenterknowledge.com/data-center-jobs/data-center-skills-gap-creates-employment-shortage

'While the pool of qualified professionals for the data center is stretched thin, the roles themselves are evolving.' [Job mutation??? Yes.]

Data Centers Scrambling to Fill IT Skills Gap
https://www.datacenterknowledge.com/archives/2017/02/07/data-centers-scrambling-fill-skills-gap

'IT career ruts happen for many reasons. If you're feeling stuck, it may have to do with your workplace culture, or with the person you see in the mirror every day. Routine work can lead to boredom. At the same time, workplace pressures may create a sense of fear, so performing tasks is no longer enjoyable and rewarding as survival instincts take over and the fear of losing a job outweighs everything else.'

- 'Set new personal goals
- Expand your network
  It's easy to fall into a slump if you operate in a silo
- Don't limit yourself to a specific career path
- Always look to solve problems
- Acquire new skills'. [my point]

IT careers: 5 ways to get out of a rut
https://enterprisersproject.com/article/2021/9/it-careers-5-ways-move-forward

Not a Career: More of a Sentence

The view from UK schools' computing education is that 'coding' is a career. Propagating this view is disingenuous and career limiting.

It is career if you want to code from the age of, say 18, to age 68 (UK retirement age). I consider that a 'sentence' not a 'career', almost inevitable if you have, or don't develop, any other IT skills.

Should any objectors to my thesis are still unconvinced, perhaps the set of links which follow and in Appendix 1 will complete their conversion to it.

A McKinsey report of factors the IT workplace people put at the top of their list for keeping them within the company was 'Career development and advancement potential'.

How far one can develop and advance when trapped in a silo skill is a debatable point, especially if that skill was the sole point of entry into IT. I maintain that the only way to give 'wings' to this factor is a solid underpinning of IT knowledge across the whole IT ecosphere.

Career development takes center stage
https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/cracking-the-code-on-digital-talent

To Continue ....

Opponents of the need for a new training path will point to the fact that there are scores of courses on all kinds of computer topics. Indeed, there are and therein lies part of the problem.

I have examined many of these courses via their syllabuses and reached the following conclusions:

- 'Despite this deluge of courses, there is a growing skills shortage which has been with us for at least two decades [see below].

  According to figures from the European Commission last year, which of course do not reflect the COVID-19 crisis, in 2020 there will be 756,000 unfulfilled IT jobs across Europe. The World Economic Forum, meanwhile, has predicted that there should be global jobs growth of 133 million by 2022 as a result of the "division of labour between humans and machines".

At the date of update of third document, the skills shortage has not diminished. Although many learned people spell out the apparent cause of this problem, nobody picks it up and runs with it.

> 'Europe faces a shortage of around 756,000 ICT professionals by 2020, with a lack of synergy between educational systems and the requirements of the labour market. Paradoxically, such changes occur whilst Europe stagnates, with millions facing reduced prospects and unemployment. E-Skills are now a major opportunity for job creation in a digital revolution.'

E-Skills and Jobs in the Digital Age [May 2017 history lesson]
https://epale.ec.europa.eu/en/content/e-skills-and-jobs-digital-age

> 'At least 133 million new roles generated as a result of the new division of labour between humans, machines and algorithms may emerge globally by 2022, according to the World Economic Forum. There will also be strong demand for technical skills like programming and app development, along with skills that computers can't easily master such as creative thinking, problem-solving and negotiating. .....
>
> The World Economic Forum estimates that more than half (54%) of all employees will require significant reskilling by 2022, but the problem is likely to be even more acute in some regions. European Commission figures show that around 37% of

> workers in Europe don't have even basic digital skills, not to mention the more advanced and specialised skills companies need to successfully adopt digital technologies. ....
>
> The companies that are successful in workforce transformation will be able to "harness new and emerging technologies to reach higher levels of efficiency of production and consumption, expand into new markets, and compete on new products for a global consumer base composed increasingly of digital natives", according to the World Economic Forum.'

The digital skills gap is widening fast. Here's how to bridge it [March 2019]
https://www.weforum.org/agenda/2019/03/the-digital-skills-gap-is-widening-fast-heres-how-to-bridge-it/

The 4-year debate: Do degree requirements still matter for IT?
https://www.cio.com/article/472345/the-4-year-debate-do-degree-requirements-still-matter-for-it.html

> In view of the 2020 estimate of a 4 m. shortfall in cybersecurity people, up from c. 3 m. a couple of years before, we might add 20-30% to numbers quoted in the first link in this section. Whichever way you slice it, the numbers are big getting bigger and current training and the pool of candidates it produces is not working.
>
> They are from disparate sources with wildly different objectives and curricula, none of which in my opinion match the current, but fluid nature of workplace, as opposed to academic, IT. As long as this persists, so will the skills shortage, which is already large and growing.
>
> There are several extant articles on IT skills and their shortage and some propose solutions; most of them that I have looked at fall into the category 'random collection of topics with no connecting theme'. See the example below.

https://uklearns.pearson.com/

A search on 'information technology' will uncover 136 courses answering to this 'call', practically all on specialist aspects of IT. You can find similar course lists at other locations but if you examine their curricula in any detail, you will find the intellectual level from the exalted to the '*PC, soldering iron and screwdriver'* level, even in a single course. Examples are *Design Patterns in Java, Linux Fundamentals, Pandas Data Analytics with Python* and *Introducing ICT systems*, which appears painfully elementary and not a substitute to what I envisage as a 'general IT course'.

As I have said, you will also search in vain for courses on mainframes or HPC (high performance computing). As I write this section, HPC is being used in the fight against Covid-19 by searching for drugs that might form the basis of a vaccine. Other work like this has been going on for years in medicine and other areas, such as risk analysis. The titles of many courses are misleading; take this one from CompTIA.

CompTIA A+ 2019 is the industry standard for establishing a career in IT
https://www.comptia.org/certifications/a#overview

- 'Demonstrate baseline security skills for IT support professionals
- Configure device operating systems, including Windows, Mac, Linux, Chrome OS, Android and iOS and administer client-based as well as cloud-based (SaaS) software

- Troubleshoot and problem solve core service and support challenges while applying best practices for documentation, change management, and scripting
- Support basic IT infrastructure and networking
- Configure and support PC, mobile and IoT device hardware
- Implement basic data backup and recovery methods and apply data storage and management best practices'

This 'agenda' is so tight as to be claustrophobic, yet claims to launch one's IT career. Anyone without any knowledge of IT would believe this was **the** entry point to the big IT world. In my view, it is a *cul de sac* and the way to becoming a *Willy Oneskill*. There is a bigger, much bigger, IT world out there waiting to be explored. *I am not criticising the content, but the title and its implications*.

- I am reserving my comments on the output of the **Institute of Coding** (IoC) which was announced early in 2018 and in November 2018 five academic bodies assigned to produce various course to increase the UK's *digital skills*.
  What that expression entails I have not been able to fathom; I assume Humpty Dumpty's principle (see above) applies.
  Unless this has been well defined, such uncoordinated exercises will muddy the skills issue even more by being a set of solutions to which the precise problem to be solved is ill-defined or not agreed.

You can see the courses (all 200+) at: https://instituteofcoding.org/courses/search/

Few of the courses have general IT pre-requisites and those that do specify something closely related to the topic in hand and not the broad underpinning knowledge I envisage; they are, in essence, co-requisites.
To me, the course list looks like a random selection of very specific courses where, apparently, no general IT knowledge is required. A big mistake. *Example:* Coursera-IBM Data Science track FAQ.

> '*What background knowledge is necessary?* This certificate is open for anyone with any job and academic background. No prior computer programming experience is necessary, but is an asset. '

This is absolute nonsense. It is akin to being taught to pilot a new ship but with absolutely no knowledge of the oceans, weather and other aspects of seafaring. A recipe for disaster.

IBM Data Science Professional Certificate
https://www.coursera.org/professional-certificates/ibm-data-science

https://www.ibm.com/training/ [actual courses]

- Very many courses are created by academics (and it shows) who have little or no workplace experience and think CS is the silver bullet[2].
- Figures about two [now more] years ago showed CS graduates had the highest unemployment rate of all graduates in the UK six months after graduation. Another report said that of all the CS graduates who gained employment, only about 30% had *real* computing jobs, moving instead to marketing and other jobs

[2] 'Every man takes the limits of his own field of vision for the limits of the world'. *Arthur Schopenhauer*.

not closely tied to computing. As Michael Caine might say; 'Not many people know that.' [*I cannot find the reference for this paragraph but I assure you I did not invent what it says*]

Skills Based Training – No Degree Needed

'The movement continues to gain traction as former National Security Advisor and Secretary of State, Condoleezza Rice endorses skills-based hiring in her interview with Fortune. Despite her numerous degrees, she recognizes the importance of hiring non-degreed talent and connecting them to high-paying jobs. Let's continue championing skills-based hiring to unlock the potential of diverse talent and create a stronger, more inclusive economy. '

IT Skills Based Hiring
https://lnkd.in/e-dUZ5e3

'That brings us to the three stages of tech career progression:

1. Getting education around the fundamental fields in technology careers.
2. Building the necessary skill set to take on an initial tech role.
3. Continuous learning and acquisition of skills to reach a more advanced position.

The biggest difference is there are now multiple points of entry, followed by the fact that we've busted the stereotype that you have to be a math or science whiz to succeed.' [I've been saying this for five or more years]

Getting Into Tech Doesn't Mean Starting from Scratch
https://www.comptia.org/blog/getting-into-tech-doesn't-mean-starting-from-scratch

'Second, we remain far too obsessed by the A-level and university route. That is a great route for many, but not for all. Relative to other European countries, we have far too many people following these routes and far fewer studying for high-level technical and vocational qualifications.' [Paul Johnson in The [London] Times, October 28th, 2019]

Education system [UK] *is failing to equip people with skills they need to work*
https://www.thetimes.co.uk/article/education-system-is-failing-to-equip-people-with-skills-they-need-to-work-ssrwhvdfl

'Almost two-thirds (59%) of global enterprises surveyed identified prior job experience or case study interview – where a candidate is presented with a business problem they must solve – as the top indicator of the candidate's data literacy. Only 18% viewed a bachelor's or even master's or doctorate as a primary consideration when hiring.'

Employers want practical data skills over data science degrees [Sept. 2019]
https://edtechnology.co.uk/Article/employers-want-practical-data-skills-over-data-science-degrees/

'More employers are starting to embrace skills-based hiring practices. Large companies, such as Boeing, Walmart, and IBM have signed on to the Rework America Alliance,[6] the Business Roundtable's Multiple Pathways program,[7] and the campaign to Tear the Paper Ceiling, pledging to implement skills-based practices. So far,

> they've removed degree requirements from certain job postings and have worked with other organizations to help workers progress from lower- to higher-wage jobs.'

Taking a skills-based approach to building the future workforce
https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/taking-a-skills-based-approach-to-building-the-future-workforce

> 'Skills-based hiring helps companies find and attract a broader pool of candidates who are better suited to fill positions the long term, and it opens up opportunities to non-traditional candidates, including women and minorities, according to McKinsey.'

Skills-based hiring continues to rise as degree requirements fade [Feb. 2023]
https://www.computerworld.com/article/3689170/skills-based-hiring-continues-to-rise-as-degree-requirements-fade.html

Why a College Degree is No Longer Necessary for IT Success
https://www.informationweek.com/strategic-cio/why-a-college-degree-is-no-longer-necessary-for-it-success

Use a Skills-Based Strategy to Address the Tech Talent Crunch
https://www.informationweek.com/strategic-cio/use-a-skills-based-strategy-to-address-the-tech-talent-crunch

Why skills - not degrees - will shape the future of work
https://www.weforum.org/agenda/2020/09/reckoning-for-skills/

I think the 'heavyweight' opinions expressed above are difficult to refute.

Unsuitability of Computer Science

I found the following 2021 link in mid-June 2022 and it backs up my long-promoted view about the unsuitability of much of computer science to meet the needs of the modern workplace. [*my comments*]
The situation in 2025 has not changed; if anything, it has worsened.

- 'Outdated Curriculum
- Lack of Right Tech Skills
- Fast Evolution of Technology [especially with AI, which render curricula over 2 years old history lessons]
- No real-time [*practical]* Experience [*theory vs. hands-on*]
- Access to ready-made Talent from Outsourcing
- Hiring Foreign Workers'

Why Do Tech Companies Not Hire Computer Science Graduates? [May 9th 2021]
https://www.synergisticit.com/tech-companies-not-hire-computer-science-graduates/

Many are specialist courses, including cybersecurity but do not appear to have IT pre-requisites, assuming that the skills can be acquired from a standing start by the general IT-unwashed. My experience says this is nonsense. Can you imagine a cardiac specialist practicing his/her specialisation without going the through general medical school?

Narrow specialisation brings its own problems. Examples:

- Inability to understand and contribute to group discussions on major projects where coherence of activity is key, as well as where one's task overlaps with topics outside one's narrow knowledge.
- The awful thought of doing the same thing from the age of, say, 21 to retirement at 68, and getting a certificate for writing 1321 algorithms plus your leaving clock.

The danger of your topic becoming business as usual where all you do is tinker round the edges of what you have already done. Where do you go from there?

The danger (and this happens) when the CFO or CEO in private industry looks at the job and asks how it affects their bottom line. If it doesn't, the question is asked:

- 'What are these 5 (e.g. AI) 'specialists' adding to my bottom line'? If a satisfactory answer is not forthcoming, the job goes and, if the incumbents are intrinsically narrow (topic-loners or Willy or Wendy Oneskills), they go with it. Finding a new job may be easy but the same thing will happen.

This is the question that is asked of all 'shiny' new products after a time or when there is a downturn in business. Today's shiny toys include AI, data science, big data and a few others, most involving big salaries; they have to pay for their keep and be measured in real money and not '*gee whizz*' currency.

The poor wretches who exit school or university clutching their Computer Science (CS) qualification are in danger of being bowled 'middle stump' in job interviews if the mainframe and its associated environment are mentioned; many cannot even spell 'mainframe'. Ditto HPC mentioned in tandem with AI, big data and similar disciplines.

The same dilemma faces even coders, or its supersets, DevOps and DevSecOps, which now talk frequently about cyber-secure code, microservices, containers, CI/CD and Kubernetes. The poor unfortunate Python-only whizz going for a development job interview faced with these terms might as well make a polite excuse and leave the premises.

> 'In terms of what DevOps skills are needed, Groll pointed out that what the survey and her own experience has shown is that, in general, organizations <u>are moving away from having employees who are specialists in a single core competency</u>. Instead, what has emerged over the past year is a model where a hybrid DevOps team is comprised of staffers who all have multiple skill sets. .....
>
> While there is a need for DevOps practitioners to have multiple skills, there is one job classification within the DevOps space that is growing faster than others. The role of Site Reliability Engineer (SRE) is the fastest growing role.' .....

[even that role needs a wide spectrum of IT knowledge, including methodologies]

The DevOps Skills of the Future Are Hybrid, Not Specialized
https://www.itprotoday.com/development-techniques-and-management/devops-skills-future-are-hybrid-not-specialized

Five Must-Have Technical Skills [US]

- Container orchestration 53%
- Security and Cybersecurity 49%
- Modern compute technology and architectures 47%
- Cloud compute platform 45%

- Multiple programming languages 45%

Five Must-Have Technical Skills [EMEA]

- Cloud compute platform 53%
- Container orchestration 52%
- Security and Cybersecurity 48%
- Modern compute technology and architectures 41%
- Application technologies 38%

Compare any computer science or 'IT fundamentals' course syllabus with these modern lists. If this list does not mandate a general IT underpinning knowledge, I don't know what does.

EMEA Upskilling 2023 Fact Sheets
https://www.devopsinstitute.com/wp-content/uploads/2023/04/Upskilling-2023-Fact-Sheets-PPT-V6.pdf

> 'Professor Alison Wolf, in her review of vocational education (2011) (*), recommended that DfE introduce study programmes to offer students breadth and depth, without limiting their options for future study or work. Professor Wolf also recommended that all young people should be able to gain real experience and knowledge of the workplace, in order to enhance their employability skills. Study programmes were introduced in September 2013. .....
> While employers may be unwilling to offer full-time employment to young school-leavers, there is a wealth of evidence indicating that they value work experience, and that the best way to obtain a job is to have one – and failing that, to at least have had one recently. This is partly because a genuine workplace teaches both general and specific '-skills more effectively than any education-based simulation can, however hard it tries; and partly because, as noted above, employers use employment records as signals that individuals have acquired important character traits and ways of behaving.'

This was suggested in 2011 but UK Prime Minister Tony Blair was adamant that everyone who could should go to university. From then on, UK polytechnics and colleges made their case to become Universities and effectively became less practical in their teaching. Thus the 'paper chase' continued.

This 'practical' approach has been resurrected and is now called '*skill- based hiring*'.
16 to 19 study programmes guidance: 2023 to 2024 academic year - 11 July 2023
https://www.gov.uk/government/publications/16-to-19-study-programmes-guide-for-providers/16-to-19-study-programmes-guidance-2022-to-2023-academic-year
(*)
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/180504/DFE-00031-2011.pdf

The link below is not strictly a 'no paper' article but reinforces the general knowledge thesis of this document.

> **'Finnigan:** Candidates looking to break into tech should expand their job search beyond traditional technology companies to include mid- to large-sized enterprise businesses in non-technical industries, which often struggle to find enough talent. These non-technical industries are seeking professionals with a diverse skill set that includes not only technical expertise but also a strong understanding of business operations and digital integration.
> By broadening their search and highlighting their cross-functional abilities, candidates can tap into this demand and find new opportunities in unexpected sectors.'

Want a Career in Tech? These 3 Tips Will Give You an Edge
https://www.itprotoday.com/career-development/want-career-tech-these-3-tips-will-give-you-edge

I am not sure where I came across the quotation below – I neglected to record it after reading it – but it explains my thesis to a ''T'.

> '*Focus on fundamentals*
> Riley says that while trending technology tends to garner the most attention from tech professionals, there are tangible benefits to stepping back and looking at the big picture of your existing systems, to consider how elements of the business are working together.
>
> "It can be easy to lose the wider vision of all the interconnected parts," Riley says. "As you develop in your career, it's natural to focus and optimize on individual pieces of the value-delivery chain. But going back to the basics and looking at the whole structure, of a business or a project, can be immensely useful.
>
> Sometimes going back to basics gives you a fresh perspective.'

[*I am recommending going back to basics from the word 'go'*, i.e. *when you start learning about IT]*.

No IT Skill is an Island

I have looked at IT curricula by the score, hence my insistence that a broad, general IT education is a must as a prerequisite to any IT career; note that I said *career* and not *job*.

I have also browsed scores of specialist course on various topics, such as AI, cybersecurity, data science and others. The common trait in nearly all these courses is that there are no prerequisites.

Let's look at two examples of apparently self-contained topics which is have summarised in a bullet list of sub-topics in cybersecurity and application development, often hidden in the word 'coding'.

A. Cybersecurity

The link below outlines the 'route map' of cybersecurity careers

Careers Route Map
https://www.ukcybersecuritycouncil.org.uk/qualifications-and-careers/careers-route-map/

The document mentions the following 16 sub-topics which 'cybersecurity' embraces.

- Digital forensics
- Cyber threat intelligence

- Cyber security generalist
- Cybersecurity governance & risk management
- Cybersecurity management
- Incident response
- Network monitoring & intrusion detection
- Vulnerability management
- Security testing
- Cryptography & communication security
- Secure operations
- Identity & access management (IAM)
- Secure system architecture and design
- Cyber security audit & assurance
- Data protection & privacy
- Secure system development

The paper then goes on to say; '*Pick a specialism to find out more'*. So, cybersecurity is not a single topic, to be learned in a short course without pre-requisite knowledge being needed. Believe it or not, many, many cybersecurity courses suggest this.

My view of cybersecurity roles that they are too granular, each role with a deep but incredibly narrow remit. This may account for the fact that, despite loud calls for more experts and people rushing to become certified and entering the field of cybersecurity. The article below does not come as a shock to me.

Cybersecurity Job Market Stagnates, Dissatisfaction Abounds [Oct. 31 2024]
https://www.darkreading.com/application-security/cybersecurity-job-market-stagnates-dissatisfaction-abounds

This unknowingly supports my thesis that a general grounding in IT will enable the incumbent to become broader in knowledge of cybersecurity and more effective.

To continue....

Take a look at another idea on what the cybersecurity *guru* needs to know. Then take a look at any cybersecurity course and its curriculum.

> 'Working in cybersecurity typically means leveraging a range of technical and people skills to protect your organization's data. Having the right set of skills could be critical to getting hired. But what skills should you focus on?'

1. Scripting
2. Controls and frameworks
3. Intrusion detection
4. Network security control
5. Operating systems
6. Incident response
7. Cloud
8. DevOps
9. Threat knowledge
10. Regulatory guidelines

15 Essential Skills for Cybersecurity Analysts in 2022

https://www.coursera.org/articles/cybersecurity-analyst-skills

Look at any of the specialism topics above and tell me that none need knowledge outside the accepted confines suggested or implied by current education.

Another four, very apposite cybersecurity articles are next:

> 'Further, Williams notes, the integration of cybersecurity staff with various skill sets can be quite difficult. "I have silos of expertise," he says. "I don't have very many people who actually can knit it together.'

What Cybersecurity Gets Wrong
https://www.informationweek.com/security-and-risk-strategy/what-cybersecurity-gets-wrong

> ' FE and HE offer a number of courses and modules related to cyber security. Within FE, courses at Levels 2 and 3 feature a few specialist courses but it is more common to take generalist IT courses, computer science or apprenticeships with a cyber security dimension as a building block instead.'

Identifying the role of Further and Higher Education in cyber security skills development
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/767426/The_role_of_FE_and_HE_in_cyber_security_skills_-_infographic.pdf

10 Tips for Landing a Job in Cybersecurity
https://www.informationweek.com/security-and-risk-strategy/10-tips-for-landing-a-job-in-cybersecurity?slide=3

> '2. Master the Basics
> Well-known security blogger Brian Krebs advises anyone who wants to break into cybersecurity to improve their fundamental computing skills. He points to a SANS Institute study that found that many job applicants lack basic understanding of topics like networking (46%), computer architecture (47%) and common exploitation techniques (66%). Rather than a working to improve your theoretical knowledge, tackle some projects that improve your practical skills with Windows, Linux, and networking. You really can't fully grasp advanced cybersecurity topics if you don't have a baseline of knowledge about how networks, operating systems, and computer hardware work.'

The next article, cited in the above link, takes my case even further

Thinking of a Cybersecurity Career? Read This
https://krebsonsecurity.com/2020/07/thinking-of-a-cybersecurity-career-read-this/

.. and this

Cybersecurity Skills Shortage

This is the root of the problem – straight into cybersecurity without a decent pragmatic stay in IT and have a basic grounding in it! Read on ...

> 'PATHWAYS INTO CYBERSECURITY ARE SHIFTING. We saw a significant shift in who is entering the cybersecurity profession and how they are doing it. Our study found that new workers are significantly more likely to have received a bachelor's degree in

cybersecurity before entering the field and are also more likely to previously have worked in a non-IT role.'

How the Economy, Skills Gap and Artificial Intelligence are Challenging the Global Cybersecurity Workforce
https://media.isc2.org/-/media/Project/ISC2/Main/Media/documents/research/ISC2_Cybersecurity_Workforce_Study_2023.pdf

I have examined a UK Cybersecurity degree syllabus and the only general IT coverage (given that most cyber people have a degree like this or a non-IT background) is as follows:

'Computer Systems, Architectures and Networks (20 credits)

Gain an overview of how a computer works, from the moment it is switched on. Explore what happens inside the machine, including how computers process input, generate output and store data. Install and configure a modern operating system, and troubleshoot hardware and software problems using real equipment and simulations.'

This reinforces my thesis that cybersecurity (any other IT specialisation) is bigger than it seems. The problem here is that the subject is treated as an island, cut off from other IT knowledge which is a mistake, and a big one.

On this particular area of IT, I rest my case 'your honor/m' lud'

B. Application Development

School computer education, and to some extent University, suggest that computing is about *coding* (in Python) and *computational thinking*. What one is supposed to be thinking about is not made clear.

The application development environment comprises (among other things);

- Coding in one or more languages
- Security aspects of applications
- The whole process of design/ code/test/recode, often called CI/CD – continuous improvement/continuous deployment

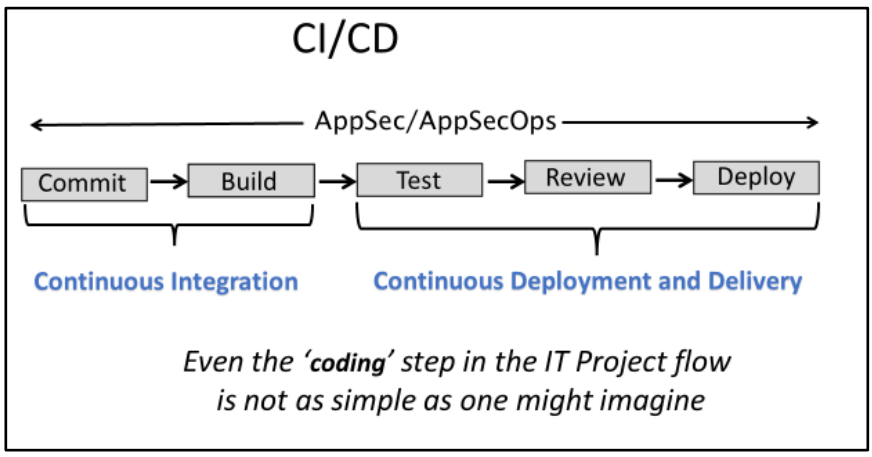


Figure 1: Coding Can Be Complicted

- Methodologies – agile, scrum, DevOps, DevSecOps and others

- Project management, milestones, reviews and other controls.

Incidentally, 'test' in the diagram above is not a single item but includes *unit tests*, *integration tests* and *functional tests* and there may be other tests depending on the work in hand, a dozen or more in fact.

In short, development is much, much more than coding, which may come as a surprise to many people and organisations. Remember also, that 'development' is only part of the IT application ecosphere.

> 'Today we live in a world where so-called low-code and no-code platforms work alongside software accelerators and AI-fuelled automation tools that can take much of the repetitive grunt work out of software systems development.....
>
> But, this doesn't mean they need to come from a conventional computer science education. Some of the best technologists in the cloud-native world are self-taught, and some even come from classics and art backgrounds. Anyone can learn to be a technologist today," she says.' [My thesis exactly]

Does a CTO need to know how to code?
https://res.cloudinary.com/yumyoshojin/image/upload/v1664292561/pdf/Future_CTO_AW_spreads.pdf

Another (hand-crafted) view of where coding lies in the development phase of things can be found in the diagram at;
Coding in Context [my title]
https://www.xeridia.co.uk/sites/default/files/valuestreammap-board.jpg

The picture below shows another perspective of app development being far wider than coding in Python or any other commercial language. It is from;

The top IT skills to have in 2022
https://landing.jobs/blog/it-skills-2022/

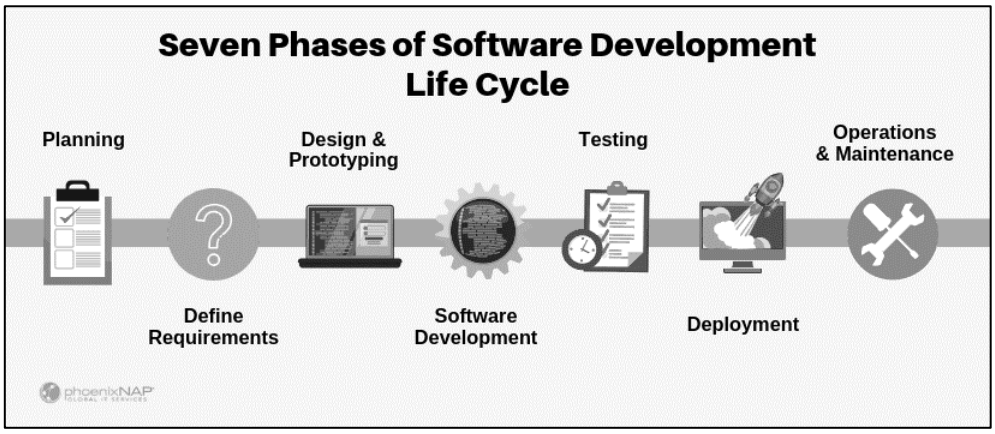


Figure 2: Phases Of Software Development

Incidentally, the UK Royal Society has a word to say about this too.

> 'There is a need for qualifications in aspects of Computing that are accessible at school level but are not currently taught [*]. There is also a need for existing inappropriate assessment methods to be updated.' [Royal Society]

Shut down or restart?

https://royalsociety.org/topics-policy/projects/computing-in-schools/report/

[*] *This is the understatement of the century*

Other Aspects Supporting 'No IT Islands'

A. The list below shows the 2022 top career development jobs. Examine the literature on these jobs and see if you think any are siloes (or lone islands) of work? By dint of this, is not the requirement for a general, underpinning IT training a necessity, as I have been saying *ad nauseam*??

- Enterprise Architect
- Full Stack Engineer
- Data Scientist
- DevOps Engineer
- Strategy Manager
- Machine Learning Engineer
- Data Engineer
- Software Engineer
- Java Developer
- Product Manager

IT Career Development in 2022: Top Stories So Far

https://www.itprotoday.com/career-development/it-career-development-2022-top-stories-so-far

B. The link below demonstrates *job mutation* where a job or role, say availability or cybersecurity, takes on a different complexion as the IT in use matures. This underlines the need for gaining a general IT education before settling into what you think is a 'job for life.'

'Only if you think, you have these qualities then go ahead and check out the below-mentioned SKILLS, which needs to acquire to be an SRE engineer:

What skills are required to become an SRE Engineer OR Site Reliability Engineer?

https://www.devopsschool.com/blog/what-skills-are-required-to-become-an-sre-engineer-or-site-reliability-engineer/

C. There are many aspects of computing which have security requirements and these are summarised in the diagram below.

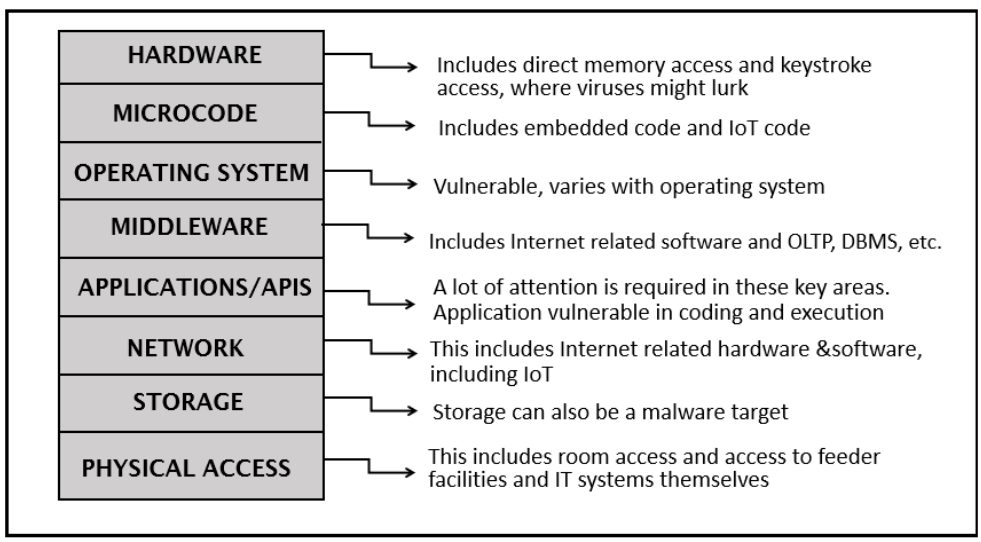


FIGURE 3: THE LENGTH & BREADTH OF CYBERSECURITY

The Scope of Hardware Vulnerability

> 'For the purposes of this work, a hardware security failure scenario describes a malicious entity (e.g., human attacker or automated malware) leveraging a weakness to violate a security policy. Each failure scenario has three aspects: how the weakness could be exploited, where the weakness typically occurs, and what kind of damage could be done.'

Hardware Security Failure Scenarios: Potential Weaknesses in Hardware
https://nvlpubs.nist.gov/nistpubs/ir/2024/NIST.IR.8517.pdf

What are the main reasons for these IT skills shortages?

When asked why IT teams were struggling with a skills shortage, the top reasons given by respondents were:

- High workloads preventing people from finding the time to upskill.
- The lack of budget for training, upskilling or recruitment.
- **Teams working in silos, preventing cross-team learning opportunities**.

https://www.techrepublic.com/article/red-hat-uk-tech-skills-gap-survey/

> 'But technical skills are not the only thing businesses need. Increasingly, employers are looking for candidates with the qualities and attributes that can bring teams together, make them more productive, and help companies navigate a work landscape that can change at a moment's notice [**]: qualities that have proven indispensable in getting employers through the tumult of the COVID-19 pandemic.' .....
>
> 'According to Robert Half's 2022 Salary Guide, the soft skills that are in most demand by CIOs are *resilience, communication, adaptability, project management* and *business acumen.'*

If you want to make it big in tech, these are the skills you really need
https://www.zdnet.com/education/professional-development/if-you-want-to-make-it-big-in-tech-these-non-tech-skills-are-essential/

[**] This means that IT has to move (mutate) as well.

After reading this 'Islands' section, tell me and the world that there is no requirement for a pragmatic, broad, workplace-oriented, general IT education plan to underpin every aspect of IT careers and the rock on which other skills, including specialisms, are based.

.. and so it goes on, and on, and on.

> 'The MoD found that its data is hard to access and share, it has gaps in critical skills, its core technology needs updating, and its processes are out of date. Defence Digital estimated it will spend £11.7 billion over 10 years updating or replacing legacy systems, and upgrading to modern replacements will be complex, said the NAO. .....
>
> "However, the MoD faces ongoing challenges with its implementation of major technology programmes and acquiring scarce digital skills. The MoD needs a clear plan for prioritising resources to where they are needed most urgently if it is to deliver its ambitions for digital transformation." '

The underlined factors above demand a broad IT knowledge; end of.

MoD's digital projects undermined by severe lack of tech skills, report finds
https://www.itpro.co.uk/business-strategy/careers-training/369347/mods-digital-projects-undermined-lack-of-tech-skills

> 'A new report (*)shows that 77% of employers worldwide are finding it difficult to fill open job roles, which represents a 17-year-high talent shortage, according to multinational staffing firm ManpowerGroup.
>
> The annual survey of 39,000 employers across 41 countries showed a 2% year-over-year increase in employers who said they're struggling to fill roles; that's more than double the difficulty reported in 2010 (31% of employers at that time).'

Nearly four in five employers struggle to fill job roles, a 17-year high

https://www.computerworld.com/article/3693014/nearly-four-in-five-employers-struggle-to-fill-job-roles-a-17-year-high.html
(*) ManpowerGroup Talent Shortage Study [link cited in report above]

> "The responsibility of learning has always been to help organizations navigate uncertainty and chaos in the world." [Linda Cai, Vice President Talent Development, LinkedIn]

My thesis is that people need to understand the territory of IT, not just one corner. A comprehensive IT education can ensure that the map of the territory is understood and later, the person can specialise in the flora, fauna, geography or geological formations. Without this knowledge, the specialiser may get lost in moving to another area.

Reskilling or upskilling is a way of developing a career when one current skill become obsolete, is no longer needed or mutates to another form. The general IT underpinning of their knowledge makes hopping from job to job much easier.

The Transformation of L&D [Learning and Development]
https://learning.linkedin.com/content/dam/me/learning/en-us/pdfs/workplace-learning-report/LinkedIn-Learning_Workplace-Learning-Report-2022-EN.pdf

> 'In addition, some companies are looking to hire more generalists over specialists and move toward skills-first hiring in order to have flexibility in terms of what projects those employees work on.

> "This means looking at candidates who have a crossover of skills and experience and can move around into different roles within your organization," says Sharlene John, head of recruitment at Selfridges.' [nested in 'Emphasizing quality of hire and generalists over specialists']

Hiring in 2023: How Talent Leaders Are Navigating a Changing Market
https://www.linkedin.com/business/talent/blog/talent-acquisition/hiring-2023-talent-leaders-navigate-changing-market

This axiom I call '*No specialisation without generalisation*'.

.. *The Debate Continued*

> Another, similar quotation, which also applied to 'digital transformation', the most misunderstood term of modern computing.
>
> > 'I am concerned that in the race to develop technology, the appreciation of developing and nurturing our fundamental skills is being undervalued. Time spent in the field or the shop floor is essential to understanding how things really work. Technological applications should be a service provider to the underlying business operation, not the end game.'

Focus on Fundamentals [2017 and the same mistakes keep being made today]
https://www.linkedin.com/pulse/focus-fundamentals-leigh-staines

A gamut of links to support my claim that general IT training in *pragmatic* IT subjects *relevant to the work place today* can be found in Appendix 1. They illustrate clearly, with quotations from many senior people, that what I am saying is true.

The Unknown World of IT

Today (4Q-2023) there is a lot of talk and emphasis on newer techniques – AI, ML, big data, data science – and how there is a shortage of people to practice these arts. Yes, there is, but this gives the impression that these are all the jobs available in IT; not true as Figure 2 below illustrates. It also implies that by simply filling these posts is a necessary condition for achieving IT nirvana. Anyone promotes this myth does not understand the full dimensions of *workplace* (as opposed to *academic*) IT.

In the diagram, the *Good Ship Business* needs to be cognisant of the material below the waterline since neglecting that can be dangerous. You will notice that 'mainframe skills' is there, below the waterline. This 'secret' topic and another are both covered in the next section.

The Mainframe Secret

A word which is never mentioned in CS and other IT training is 'mainframe'. *They're dead, aren't they*? Far from it, and in many cases provide the best 'bang for your buck' around, particularly in enterprise environments.

See the link below for a demolition of the myths about the mainframe today. The world of finance would cease to operate if mainframes were as scarce as some people claim. The statistics on mainframe usage in the document below are mind-blowing and ask the question;' Why is the mainframe not covered in school and University computer courses?

Mainframe computing is a career, not just a job and there are thousands of vacancies for wannabe '*mainframers*'. Answers on one side of the paper only.

The Mainframe Lives
https://drive.google.com/file/d/1XKCzuj1jgw8wZhRPhbuZawjYDNu42HbM/view?usp=sharing

A plus for the mainframe is that much of the work involves COBOL, an easy language to learn, although it does not exclude other languages aimed at modernisation.

Mainframe Message: 'Come in, the water's lovely'!

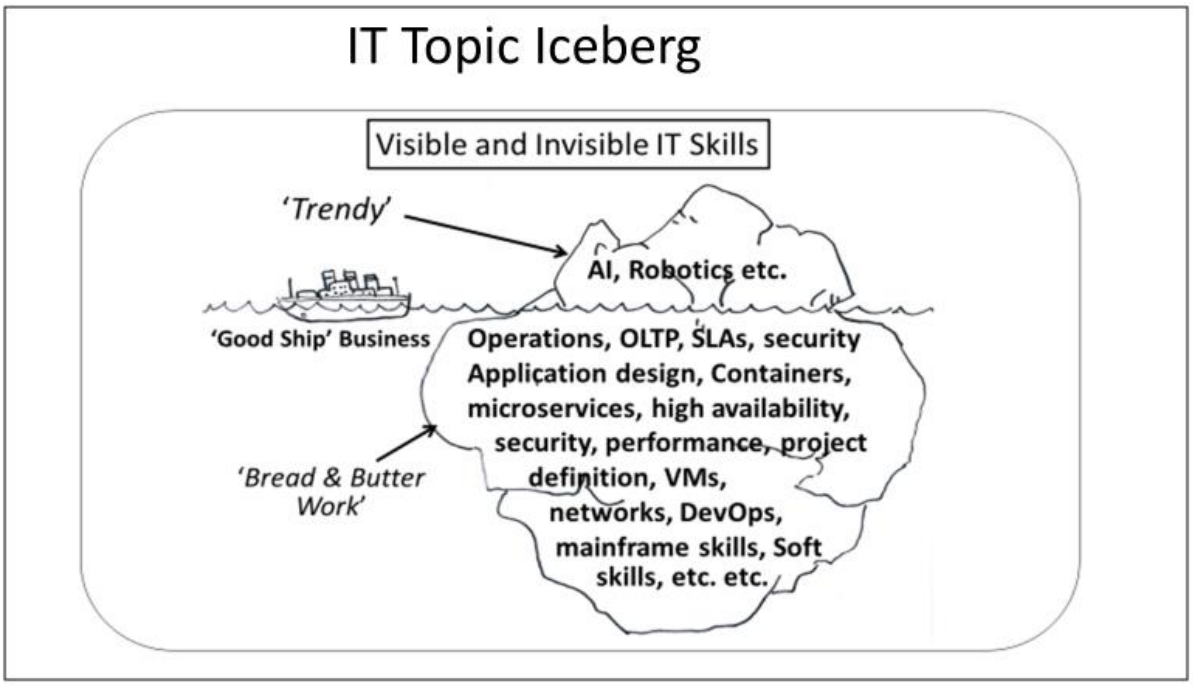


FIGURE 4: THE IT ICEBERG

In the diagram, the *Good Ship Business* needs to be cognisant of the material below the waterline since neglecting that can be dangerous; *remember the Titanic*. You will notice that 'mainframe skills' is there, below the waterline. This 'secret' topic and another are covered in the next section.

> More often than not, the 'shiny' new jobs, for example AI and data science, feed off operational and other data from below the waterline and it behoves the 'shiny job' incumbent to know something about what is below this waterline. In addition, if the quality of data is not maintained by solid IT operational rigour, then the results of such further analysis may not be trustworthy. Neglect these sub-waterline areas at your peril.

By the way, even the subjects at the top of the iceberg are not free from exaggeration of results and importance.
The 6 most overhyped technologies in IT [August 2022]
https://www.cio.com/article/405106

Scientific Computing Secret - HPC

I have never come across any mention of scientific computing in a CS curriculum; even where 'data representation' there is no mention of floating-point arithmetic. *This is a big, career limiting mistake*. Scientific computing of old was reserved for particular disciplines such a chemistry, computer aided design (CA) and various types of engineering disciplines. It was often carried out by the archetypal mad professors with tufty side-hair and shiny domes and was not a job for the common man or woman.

The people who developed in this environment were denizens of that particular discipline, some of whom renounced the scientific part to become developers. Today, however things are very different and machines are developed to produce performances of zillions of instructions per second ('ZIPS'), not just as a 'me too' exercise and an attempt to get into the top performers table.

Today, scientific computing and bioscience go hand in hand in the development of drugs and methodologies in various areas, such as gene therapy. As I write, many bodies are doing high performance work in the Covid-19 area on vaccines, mutations and other aspects of the virus.

The Japanese supercomputer Fugaku [at the time of writing] has taken the top spot in the list of 500 most powerful supercomputers in the world weighing in at over 415.5 quadrillion computations a second (petaflops) and test thousands of substances per week in the search for a coronavirus cure.

On top of this, artificial intelligence (AI) is being used in finance and other business areas doing forecasting, risk analysis and other work which benefits from thousands or millions of iterations. They all benefit from massively parallel processing, a feature not available to normal commercial computers doing applications such as invoicing.There are careers by the score here but simply having a knowledge of AI may not be enough and an inkling of the scientific method and the subject under study will be a great advantage.

Coding/development languages used in this sphere of work are the old FORTRAN veterans, C and C++ compilers for big jobs, Python, MatLab and Julia. It is thus a place for avid coders to live.

A Possible Solution

I have a draft solution on the drawing board but suffice it here to state the need for such a project. See https://tcritchley08.wixsite.com/real-it .

Appendix 1

Supporting Opinions

In what follows, much of it comes from the mouths of CIOs (chief information officers) and their equivalents and is therefore from the *computing frontline* and not academia. Their advice carries more weight than that of academics, however learned and erudite the latter may be. If you are a sceptic, you only need to read as far as is necessary to convince you of my thesis; if you are already a convert, move on to Appendix 2, unless you need to reinforce your commitment.

Here Beginneth the Lesson

This section is devoted to demonstrating the broad support for *broadening* and *continuing* IT education at any level of competence. The structure of this section follows the format:

'*Quotation from a source'* [my comment]
Name of source
https://sourceof the quotation

Do not attach any importance to report dates; IT has been changing for decades. You will note that across all these extracts, the main and common theme applied to IT education is; '*Wider still and wider, shall thy bounds be set ..*' – Elgar's *Land of Hope and Glory*.

They will find this exercise hard work for Willy Oneskill or Sophie Soloskill, underlining my argument for a *broad underpinning education* from the start. The attempts by successive Governments to reskill the workforce have consisted of promises and wish lists, often accompanied with fanfares and £mega money promises but little action.

'As a result, companies are trying harder to throw a wide net for talent, rather than a narrow net for skills. Hiring curious problem solvers rather than people with the four specific certifications in the job rec.'

IT + Observability How a convergence of trends and technologies will reshape resilience in the year ahead
https://www.splunk.com/en_us/pdfs/gated/ebooks/it-observability-predictions-2023.pdf

The IT skills shortage, over 20 years old is, like the poor, always with us. Anyone who does not believe my thesis after reviewing the evidence below is living on a different planet. Unfortunately, that planet is well populated.

If, in going through the articles in the following pages you surrender to my 'generalisation' *argument, then you have permission to move on to the next major section. If not, please read on.*

Before this, I remember the advice given by a rugby coach to the team before a game: 'don't forget lads, get your retaliation in first.' I am taking this advice here.

coup de grâce I

> 'The World Economic Forum estimates 150 million new technology jobs will be created globally over the next five years, with over three-quarters (77%) of all jobs set to require digital skills from workers by 2030. Right now, only a third (33%) of technology jobs worldwide are filled by the necessary skilled labor.
>
> From a business perspective, this means the talent pool is severely diluted – for each skilled worker, and there are two other unskilled, unequipped ones. And it's clear that, without reskilling and better preparing the workforce with the new digital and technology skills demanded by this changing job market, many workers risk long-term unemployment.
>
> One thing is for sure, for those businesses looking to what the future holds: without rapidly changing the ways in which we reskill and upskill workers, this mass of untapped potential will only continue to grow as more new technologies emerge.'

Navigating the Global Technology Skills Gap with AI-Moderated Upskilling
https://www.networkcomputing.com/careers-and-certifications/navigating-global-technology-skills-gap-ai-moderated-upskilling

coup de grâce II

This is an apposite quote from a National Academy Press (NAP) supporting my thesis about the need for a background IT knowledge whatever specialised job may be chosen. I do not believe that any Computer Science or IT fundamentals courses I have looked at do this.

> 'Generally, "computer literacy" has acquired a "skills" connotation, implying competency with a few of today's computer applications, such as word processing and e-mail. Literacy is too modest a goal in the presence of rapid change, because it lacks the necessary "staying power." As the technology changes by leaps and bounds, existing skills become antiquated and there is no migration path to new skills. A better solution is for the individual to plan to adapt to changes in the technology. This involves learning sufficient foundational material to enable one to acquire new skills independently after one's formal education is complete.'
> [This is my thesis in a nutshell]

Being Fluent with Information Technology
http://nap.edu/6482

> 'Atsumori joined IBM in 2006, after earning a master's degree in Information Technology. At IBM, he first worked as an Infrastructure Engineer, followed by Cloud Platform Technical Sales, engaging in the Cloud proposal activities across industries.' [*general before special; with a single bound he leapt from one specialisation to another*]

Continuous Learning: It's the Best Way to Grow
https://www.ibm.com/blogs/ibm-training/continuous-learning-its-the-best-way-to-grow/

coup de grâce III, IV, V etc

These 2 papers (4Q 2021) encapsulate my thesis that a general, comprehensive IT education should precede specialisation

- '*Flourishing*: Product management
- *Flourishing*: Cloud and container technology
- *Flourishing*: Leading change
- *Flourishing:* Software engineering
- *Flourishing*: Cybersecurity mindsets for all
- Fading: Single technology expertise [*Wendy Oneskill*]
  IT professionals looking to stay competitive should avoid becoming overly specialized in niche products or technologies."
- Fading: STEM degrees always required [*Shock, horror*]
  "We see more and more companies hiring people based on the skills that they have, not based on a degree," says Jim Chilton, CIO of education technology company Cengage Group, noting that his IT organization has gone degree-blind for many of its roles. "This requirement will continue to become more optional for many jobs and industries."
- Fading: Traditional PMO leadership
- Fading: Tech-only contributors' [*Willy Oneskill*]

IT careers: 5 flourishing and 4 fading IT skills for 2022
https://enterprisersproject.com/article/2022/1/it-careers-5-flourishing-and-4-fading-it-skills-2022

'The UK's digital skills gap could pose a risk to economic recovery, new research from Microsoft reveals, with over three-quarters of UK leaders citing a large digital talent pool as essential to driving UK competitiveness.'

UK's digital skills gap poses risk to economic recovery, research reveals
https://news.microsoft.com/en-gb/2020/11/23/uks-digital-skills-gap-poses-risk-to-economic-recovery-research-reveals/

The term skills gap refers to the variance between the performance employers desire from their workforce and what workers can or choose to deliver. CompTIA research suggests that 1 in 2 IT and business executives report that the skills gap situation at their organization has grown over the past two years. These gaps are present in every part of the IT industry but are most prominent in these 7 areas:

- Innovative technology, i.e., IOT, AI and automation
- Integrating apps, data sources, platforms and devices
- Cloud infrastructure
- Digital business transformation
- Cybersecurity
- Software development
- Data management

> Simply put, 87% of IT and business executives surveyed share the belief that too many workers lack the advanced skills needed for these job roles and beyond.

https://www.comptia.org/content/research/assessing-the-it-skills-gap

> A study from Hays in January 2023 found that 95% of employers seeking tech talent encountered skills shortages across 2022. The survey of UK employers noted that 94% faced a "lack of talent" in their hiring searches in 2022, which marked an increase from 89% in the year prior.

https://www.itpro.com/business

The IT Skills Shortage Expands and Deepens
https://www.informationweek.com/team-building-and-staffing/the-it-skills-shortage-expands-and-deepen

UK's digital skills shortage reaches "all-time high" [Nov. 2021]
https://www.itpro.co.uk/business-strategy/careers-training/361473/uk-digital-skills-shortage-all-time-high

Skills gap is at an all-time high despite increase in computer science students [September 2022]
https://www.itpro.co.uk/business-strategy/careers-training/369134/skills-gap-is-at-an-all-time-high-despite-increase-in-computer-science-students

> 'The *2022 IT Leaders Pulse Report* reveals that almost three quarters (73%) of senior IT leaders agree that acquiring IT talent has never been harder, and nearly all (98%) respondents say attracting IT talent influences their organization's technology investment choices.'

All this despite billions spent on IT education on hundreds of courses. '*I deduce, Watson, that there is something missing in this case*'.

> *IT Talent Gap Is Fueling Tech Investment Decisions*
> https://www.apmdigest.com/it-talent-gap-fueling-tech-investment-decisions
>
> 'Employees themselves are similarly anxious about the widening skills gap, with 46 percent of those surveyed believing their current skill set will become irrelevant by 2024.' [job mutation]
>
> 'Filling the skills gap is a top priority. 64% of L&D professionals said that reskilling the current workforce to fill skills gaps is a priority now.'
>
> 'The skills gap is here and it's growing — nearly one-third of employers surveyed agree that the skills gap has increased from a year ago. This reality contributes to the difficulties of sourcing qualified candidates, with 87% of employers reporting they have trouble finding qualified talent as a result.'

10 need-to-know skills gap statistics for 2022
https://www.instride.com/insights/skills-gap-statistics/

> 'Capital Group leadership believes employee satisfaction is just as important as customer satisfaction, and a key part of that is ensuring that employees have ample opportunity to grow their careers within the company. This includes internal bootcamps, courses for developing subject matter expertise, and an internal talent marketplace that gives employees more mobility within the organization.'

> ‘Upskilling and cross-training programs are key factors in improving employee productivity, retaining top talent, and filling skills gaps. Financial services company Capital One focuses on “developing the whole person” by leveraging internal professional development programs, including a full-stack development academy, the Capital One Developer Academy (CODA), and Capital One Tech College.’

This, in short, gives examples of job mutation by education and the equivalent of internal apprenticeships.

Talent development: 4 upskilling success stories
https://www.cio.com/article/100000070/talent-development-4-upskilling-success-stories.html

The article below points to the fact that raw IT talent, typified by young people, often graduates, suffer from their lack of IT *battle experience*. This supports my thesis of general IT training plus apprenticeships as the optimum way of getting IT *warriors* into workplace IT.

Understanding the skills gap
https://www.thehrdirector.com/features/apprenticeships/understanding-skills-gap/

> ‘"For instance, could you get people in and teach them how to code in Python? Or get a team together and give them the tools and access to raining to learn how blockchain works. The benefit is they'll see things in different ways. The outcome you want is that your staff to increase their capability and see the world in a different way."’

Why training is broken in the age of Covid

https://www.computing.co.uk/news/4038783/training-broken-age-covid

> ‘Even before the pandemic, it was clear the education system was failing to deliver many of the technical skills that sectors such as the digital economy, engineering, construction and care require. The Office for Budget Responsibility forecasts that unemployment could hit 13 per cent in the next few years from 4 per cent now. Millions of people may find themselves in need of retraining. And it is far from clear that the system is equipped to provide them with the skills to switch to new careers....
>
> That said, Mr Johnson had little new to offer. Many of his proposals had first appeared in the Augar review of post-18 education commissioned by Theresa May and published last year. These included plans to spend £1.5 billion upgrading further education college buildings and the establishment of a “lifetime skills guarantee” that would entitle every adult access to four years’ worth of funding. This could be spent on any course, whether a degree or a technical qualification, at any point in their lives. Mr Johnson is also promising to offer any adult without an A level the chance to study for a new technical qualification in skills in demand from employers.’

The Times, Wednesday September 30 **2020**
The Times view on Boris Johnson’s vocational training plan: Missing Skills

> ‘Despite accelerated digitalisation in response to COVID-19, a clear digital skills gap persists in UK organisations:
>
> Business leaders lack faith in both the education system and government to resolve the UK digital skills gap:’
>
> *‘Productive digital skills*

- Training and developing AI and algorithms for machine learning programs in addition to knowing how to apply them to overall business objectives
- Creating digital materials using coding or digital editing techniques
- Developing and/or working with mixed reality interfaces, such as wearables and haptic touch technology
- Analysing and understanding collective data and databases
- Database development and maintenance
- Computer science modelling
- Hardware, robotics and mechanical engineering
- Security and risk management.'

My Comments: This set of skills is typically academic and emphasises flavour of the month (shiny new ideas) and ignores the core (bread and butter) skills that manage the computer and its data; SLAs, Virtualisation, microservices, containers, systems management, high availability, performance, mainframes, scientific computing, graphics and a host of other skills needed to keep the computing wheels turning.

Such skills rarely come from new companies but are germane to successful computing in the service of business. I have never come across a course which covers any of these topics and, believe me, I have studied many, many of them via curriculum and syllabus searches. In addition, I have not come across the placement of any topic in the workplace environment, answer the 'so what?' questions; in other words, the current education lacks context.

The extract below echoes my thesis that CS is not the correct vehicle to ride the changing world of IT and the training attached to it. Both need to be time- and change-sensitive and presented as a coherent whole, in which neither criteria are met by CS.

> 'The Tech Industry Gold industry accreditation is the result of a unique collaboration between universities and industry, successfully addressing the low employment rates of computer science graduates. Employers and HEIs work together to co-create curricula that develop the capabilities most sought after in the workplace, covering technical, business, project and professional skills.
> Employers also remain engaged with students through the delivery of the programmes. The results from this collaboration have been exceptional, reducing unemployment rates from 8% to 3% when compared to traditional computer science degrees, whilst also encouraging greater diversity, doubling the proportion of females on programmes with 37% of graduates identifying as BAME.'

Fast Forward for Digital Jobs [click on 'report' link in this page]
https://www.techuk.org/shaping-policy/fast-forwad-for-digital-jobs-report.html

Unlocking the UK's potential with digital skills
https://info.microsoft.com/rs/157-GQE-382/images/Unlocking-the-UKs-potential-with-digital-skills_131120__v3.pdf

The link below, expands [at some length] on the theme of generalisation being of great value versus acquiring and honing a single skill - *George General vs. Willy Oneskill*].
Cafe Con Luis: The Future Belongs to Polymaths | WEBCAST
https://youtu.be/9t0JOF4IxYU

IT leaders re-evaluate skillsets for the long haul

https://www.cio.com/article/3615530/it-leaders-re-evaluate-skillsets-for-the-long-haul.html

> 'A post-pandemic tech job landscape will be very different, with traditional distinctions between jobs and disciplines becoming less well defined as business leaders see they will need people with a broad skill set that isn't totally tech-based. Tech vacancies are now more customer-facing which illustrates how critical interpersonal skills supported with tech knowledge are in great demand. ....
>
> Tech jobs are also evolving. The Demand for Skilled Talent report from specialist recruiter Robert Half shows a shift towards a hybrid skills approach, which they define as more soft skills. '

Post-pandemic tech jobs [June 2021]
How has the pandemic changed the tech jobs landscape, and which tech jobs will be in demand throughout 2021?
https://www.itpro.co.uk/business-strategy/careers-training/359732/post-pandemic-tech-jobs

Tech job vacancies hit 10-year high amid soaring demand for digital skills
https://www.uktech.news/recruitment/tech-job-vacancies-digital-skills-20220715

Older Workers

The Times report below outlines the additional investment in digital equipment during, and planned after, the Covid-19 pandemic. This fact does not sit easily with the existing chronic shortage of suitable IT skills,

> 'Another report by the London School of Economics found that companies have been innovating at a much faster pace than they would have done otherwise. In a survey of several hundred companies, it found that more than 60 per cent of businesses invested in digital technologies and new management practices between March and July last year. A total of 45 per cent said that they had introduced new products or services during the period and about 38 per cent had adopted new digital capabilities.'
>
> 'The relative lack of over-50s working in the UK tech industry suggests there's a desperate need to upskill older members of the workforce, research by BCS, The Chartered Institute for IT, claims.
>
> Only 22% of those working in the IT industry are older than 50, versus 31% in the wider workforce, the report claims. Equitable representation would translate to there being an additional 119,000 IT specialists in the UK, and 480,000 in total. '

Pandemic [technology] investment could lift output
https://www.thetimes.co.uk/article/175b1090-c30a-11eb-a26e-4c086490cfe1

> 'There are now more people aged 50 and older in work or looking for work than since just before the pandemic, according to data from the Office for National Statistics (ONS).'

Britain's 'great unretirement': cost of living drives older people back to work
https://www.theguardian.com/business/2022/jul/25/britains-great-unretirement-cost-of-living-drives-older-people-back-to-work

> '*Retirement hastens onset of dementia'*: Times, 25th January 2018
>
> '*Over-50s encouraged to end early retirement*': Times 24th December 2022. Plea by Rishi Sunak, Prime Minister of the UK.

This age group are not going to attend university, especially computer science courses, which do not have the broad, pragmatic content needed in the workplace today. I think I demonstrate this throughout the whole of this document.

Lack of over 50s in tech points to need for urgent reskilling
https://www.itpro.co.uk/business-strategy/careers-training/360134/lack-of-over-50s-in-tech-points-to-need-for-urgent

> 'Yvonne Smyth, group head of equity, diversity and inclusion at recruitment firm Hays, says: "Organisations are definitely more aware of older workers being an untapped and potentially overlooked talent pool." ' [IT isn't]

'Championing age': how business can win back older workers
https://www.raconteur.net/workplace/older-workers-labour-shortage/

Relevant links referenced in the link above are:

BCS diversity report 2021: Age [July 2021]
https://www.bcs.org/policy-and-influence/diversity-and-inclusion/bcs-diversity-report-2021-age/

> 'But professor Rose Luckin, of the UCL Institute of Education, said: "I do not feel that at the moment we are equipping either students in school or workers in the workforce with the requisite skills to know how to adapt themselves to use the automation they are being offered to best effect. We need to take that on board and make some changes to address it." '
>
> 'As a nation, we must respond with a readiness to re-skill, and up-skill, on a continuing basis.
>
> "This requires a commitment by the government to ensure that our education and training systems are flexible, so that they can adapt as the demands on the workforce change, and are geared up for lifelong learning. Leadership in this area, however, has been lacking."

If you look at the date of the report below, and study the other links in this section, you will see that this status quo persists in to 2021 and probably much longer.

Government 'must reskill UK workers to survive AI automation' [Oct **2016**]
https://www.itpro.co.uk/government-it-strategy/27392/government-must-reskill-uk-workers-to-survive-ai-automation

Pandemic [technology] investment could lift output
https://www.thetimes.co.uk/article/175b1090-c30a-11eb-a26e-4c086490cfe1

How to know when AI is the right solution

https://www.cio.com/article/303218/how-to-know-when-ai-is-the-right-solution.html

> '"But with COVID, what I've realized ... is that it's not only about knowing the material and understanding their field of study a little bit more. A lot of my students have been asking me how they can apply their learning and bring assignments to life," Freberg said.
>
> This paradigm shift has presented institutions with the challenge of transferring hands-on learning experiences to an online format that is collaborative and rigorous enough to prepare students for real-world applications.

> In response to this, many institutions are using this challenge as an opportunity to connect with local organizations and community partners to provide educational opportunities that align with jobs.' [Isn't that called an apprenticeship?]

Seems to me an awful waste of time spending 3 years on a course that need massive complementary 'extras' which any seasoned IT person will tell you are not 'optional'; they are part of the fabric of real-life IT.

3 Ways to Add Value to Online Instruction and Redefine Student Success [NNB McVey]
https://edtechmagazine.com/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/higher/k12/article/2020/11/3-ways-add-value-online-instruction-and-redefine-student-success

' The number of school students studying for a computing course is predicted to halve by 2020 and those who go on to study computer science at university have been deemed statistically less likely than other STEM graduates to find employment after graduating, despite the demand for IT talent. It's impossible not to draw the conclusion that the skills needed by business are either not being taught correctly or are not being taught at all.'

Mind the Gap: How Brexit will Affect Britain's Mainframe Skills Shortage [Sept2018]
https://www.cbronline.com/opinion/mainframe-skills-brexit

> 'Why does this 'geek' stereotype matter? For starters, it's demeaning to everyone who works in technology, no matter their gender. It belittles their skills and in the case of developers, their craft (yes, coding is a craft and highly creative.) Perhaps more importantly, it acts as a colossal barrier to entry for the young people that technology so desperately needs to attract. The shortfall in digital skills, particularly acute in areas such as cloud native development and data science, has been extensively chronicled across both industry and mainstream media. Salaries have risen in line with demand - but employers are still struggling to find the skills they need to help them secure their exit from the COVID-19 doldrums'.

The skills needed are far wider than those mentioned in the above extract which appears to have been written by a development person.

Yet more proof of the need for broad IT training can be found below (my underlines):

> 'What Were the Main Challenges During Your Organizations Initial Cloud Platform Deployment Project?
>
> - Security requirements 57%
> - Lack of staff expertise 44%
> - Understanding application performance 40%
> - Onboarding of legacy applications 38%
> - Ability to plan for cloud capacity 32%
> - Consistency with corporate DR planning 30%
> - Ability to manage Operating System images 28%
> - None of the above 9% '

This means that 91% of required skills were missing (doesn't it?). Show me a CS or cloud course curriculum which covers these [underlined] shortfalls.

Delivering Effective Service Automation Through Cloud Technologies

https://www.enterprisemanagement.com/vendors/infographic_gallery.php#ema-heat-cloud-0415-infographic

The next link reinforces this IT training need post-Covid.

> 'Many large employers are creating those upward career paths—for example, taking the best low-wage employees and putting them through management or digital training. But some companies and sectors will simply see lower head counts, and that is where educational institutions and governments need to step in. One thing we learned over the past five years is that short-term training programs can teach individuals the minimum skills needed to get a job, such as to the lowest level in nursing, in a matter of weeks. To move up to registered-nurse status takes more education, but at least somebody can start on that upward career path.'

The key messages in this paper are that job changes become necessary (*) and one does not have to be degree material to start on the path to a difference career. This is my message for IT training.

(*) A study in another paper indicates that up to 30% of employees will change jobs post-Covid so job changes are not only dictated by circumstances.

The workforce of the future [May 2021]
https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/the-workforce-of-the-future

The next link predicts mainframe skill shortage of c. 300,000 in 2025, not that far off when you consider how long it takes to get an effective mainframe 'guru'.

> 'In the big picture, Uptime projects that staff requirements will grow globally from about two million full-time employee equivalents in 2019 to nearly 2.3 million in 2025. '

6 data centre trends to watch [look for data centre staffing.]
https://www.arnnet.com.au/article/691778/6-data-centre-trends-watch

Why it's time to retire the techno-geek
https://www.computing.co.uk/opinion/4030231/retire-techno-geek

> 'I now meet with experts that are 1 metre wide and 2 km deep.'
> I have been uttering statements like the above for years, verified by talking to 'experts' at IT trade shows. Ask a question like: 'Oh, that sounds bit like [something similar, trying to get my bearings on the topic] doesn't it? only to be met with a blank stare.
>
> 'In my view, a new class of education and university degree is required to address the general field of systems and complexity from a scientific stance to aid the realisation of sustainable societies.'

Hallelujah! A disciple of 'the general before the specific', my mantra in IT education.

O'Reilly (July 2022) have decided that 'general' is good, as per the extract below.

> 'Today it's not enough to know a programming language inside and out. You also need to understand the cloud. And containers. Maybe AI. Not to mention deeply important responsibilities like security and accessibility. Plus, you still have to keep up with what's happening in the tech industry at large. It's a huge task, and it's getting bigger by the second. So we've decided to widen the scope of our newsletter by focusing on O'Reilly's Radar (our ability to read the faint signals of emerging trends to see what's coming that's important and useful).'

O'Reilly Newsletter 2nd July 2022 announcing a broadening of its coverage.
https://www.oreilly.com/

> ' "The best way to ensure IT professionals are future-proofing their careers is by remaining flexible and adapting to change."
>
> Avila advised IT workers to remain up to date with current trends that may affect their roles and develop cross-disciplinary expertise to elevate their value.'
>
> "The ability to be flexible and adaptable to change, coupled with strong communication, will be essential skills as IT professionals navigate a constantly changing IT landscape," he said. [*Nicolas Avila, CTO of North America at Globant*]

IT Jobs Outlook 2025: Evolving Skills, AI, Workplace Flexibility Will Shape IT Workforce
https://itprotoday.com/career-management/it-jobs-outlook-2025-evolving-skills-ai-workplace-flexibility-will-shape-it-workforce

Gartner too are chipping in and their extract below, under 'Build a digital-ready workforce', supports my thesis of 'general before special' to the hilt.

'Skills
Recruit for technical versatility
Seek staff with the ability to adapt and work in more versatile technology roles.'
https://www.gartner.com/en/information-technology/insights/digitalization-transforms-it

And yet another outside view:

Peter Cochrane: Where are the generalists we need today?

> 'We need more generalists with a broad multi-disciplinary education and experience, but education is heading in the opposite direction'.

https://www.computing.co.uk/opinion/4022661/peter-cochrane-generalists

It Takes Strong Cybersecurity to Keep Organizations Healthy [see p. 6 for underpinning skills needed]
https://healthitsecurity.com/resources/white-papers/it-takes-strong-cybersecurity-to-keep-organizations-healthy

> ' "I think the data center industry is a little bit invisible to colleges and even tech schools. It's starting to get more visibility. At Uptime we're working with local colleges to even acquaint their STEM students to the fact that there's an entire industry out there that they should be considering."
>
> Community colleges also offer a great opportunity for getting future hires in the pipeline, because of their mandate to provide vocational training to meet the needs of their local economies.'

The speaker here is Lee Kirby, cofounder of Salute, an organisation helping services veterans into the data centre industry. The UK lacks such a facility.

Addressing the Data Center Skills Shortage
https://www.datacenterknowledge.com/uptime/addressing-data-center-skills-shortage

> 'These marketplaces can enable people who suddenly and themselves bereft of their normal job tasks to quickly and easily and different work using their core or adjacent skills where their contributions make a difference.'

How the Coronavirus Crisis Is Redefining Jobs
https://enterprisersproject.com/sites/default/files/redefining_jobs.pdf

This 'job mutation' is a common theme in this document as are the frequent allusions to 'broader or general skills'.

> 'And since digital solutions are by their nature cross-functional, the ability to collaborate and co-create solutions—and even to train business colleagues in digital concepts and capabilities—is paramount. .....
>
> The pace of technology change has become so rapid that in 2020, many companies will shift the focus of their talent strategies away from specific narrow roles, skills, and competencies to a broader set of capabilities. "Hard" and "soft" skills will both be in greater demand. .....
>
> Of course, when everyone is seeking the same valuable and not-yet-widespread skills, such as machine learning, it may be too expensive to hire those skills fully developed and take too long to grow them internally. That's why one Boston area CIO and others like him are initially "renting" such skills from a professional services firm. .....
>
> These are "the aspects of the job that aren't changing next year or the year after," he says. "They're much more durable" than the technologies *du jour*. "You know, it was big data yesterday, it's cloud today, it's going to be something else tomorrow." '
>
> 'ALERT: A list of tools is NOT a professional skills inventory BUT all too often this is the situation. It's like saying the skill of arboriculture (tree surgery) and cabinet making are the same because they both use a saw!!'

Wisdom
https://skillstx.com/wisdom

> 'A job for life is a rare thing today, not necessarily because of a lack of loyalty, but because of the pace of change in technology and the vast amount of choice this generation has. This is why constant training and upskilling is so appealing when considering employers and research bears that out.' .....
>
> '67% of people would improve their digital skills if they knew support was available to help them if they needed it.'

Using digital upskilling to make a wider impact
https://www.raconteur.net/sponsored/work-rewired/using-digital-upskilling-to-make-a-wider-impact/

IT Talent Strategy: New Tactics for A New Era
https://enterprisersproject.com/sites/default/files/it_talent_strategy_new_tactics_new_era.pdf

Digital transformation held back by lack of skilled people
https://www.computerweekly.com/news/252483982/Digital-transformation-held-back-by-lack-of-skilled-people

> 'The CIO of U.S. Gas & Electric in North Miami Beach recently hired four new staffers and was looking to add 11 more people to his team of 20. His list of open positions included an EDI programmer, a risk management programmer, a CRM programmer, a business analyst and an assistant IT manager.
>
> Taffet says he doubts any new college grad could easily fill any of those roles. Undergraduate and graduate schools aren't able to keep up with the needs of enterprise IT shops, he says.'

The skills mentioned in this article are:

1. 'Business basics
2. Systems integration
3. Emerging technology expertise
4. Technical basics [low level, scripts etc.]
5. Familiarity with legacy systems
6. Ability to work on a team.'

Anyone who doubts my thesis should read these articles (both links below) from beginning to end.

> ' "Universities, in general, are not sharing with their students the necessary leading-edge enterprise technology skills that corporate America [and other countries] needs," ;

Businesses Need Enterprise Skills, Universities Don't Deliver
https://techchannel.com/Enterprise/03/2021/enterprise-technology-skills-bootcamp

6 Key Skills IT Grads Lack [2012!]
https://www.computerworld.com/article/2501316/6-key-skills-it-grads-lack.html

Volatility is the new stability in the 20s. This is especially true of information technology.

- Data shows the total number of skills required for a single job is increasing year-over-year by 10%
- 33% of the skills that were present in an average job posting in 2017 *won't be needed by 2021* .....
- Help employees stay up-to-date with evolving skills information.

How to Build a Resilient and Responsive Organization
https://emtemp.gcom.cloud/ngw/globalassets/en/human-resources/documents/trends/gartner-how-to-build-a-resilient-organization.pdf

Parents claim soft skills are needed for future of work
https://www.computerweekly.com/news/252483982/Digital-transformation-held-back-by-lack-of-skilled-people

> 'About two thirds of those in computer programming and IT say they need ongoing training and skills development to get ahead, according to a 2016 Pew study.'

20 ways to kill your IT career (without knowing it)
https://www.cio.com/article/3239287/20-ways-to-kill-your-it-career-without-knowing-it.html

- 'Finding adaptable learners. Tech talent has always been accustomed to lifelong learning as their fields change and new ones emerge. Technology skills evolve so quickly that focusing solely on credentials and specific skills when hiring is not enough. In addition to specialized talent, the best companies look for "strong talent," which has the ability to learn and adapt. As one executive said, "We're not looking for people with skills; we're looking for people who can learn skills." '

How companies can win in the seven tech-talent battlegrounds
https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/how-companies-can-win-in-the-seven-tech-talent-battlegrounds

> *Pew Study:* 'Many see personal upgrading as a constant: More than half (54%) of adults in the labor force say it will be essential for them to get training and develop new skills

throughout their work life in order to keep up with changes in the workplace. And 35% of workers, including about three-in-ten (27%) adults with at least a bachelor's degree, say they don't have the education and training they need to get ahead at work. ....

The role of college is being debated: While many college graduates with two- or four-year degrees describe their own experience as having a positive impact on them, just 16% of all Americans think that a four-year degree prepares students very well for a well-paying job in today's economy. And there is no consensus regarding the main purpose of college. Roughly a third of adults (35%) say it should be to help individuals grow personally and intellectually, while 50% say it should be to teach job-related skills.'

The State of American Jobs
https://www.pewsocialtrends.org/2016/10/06/the-state-of-american-jobs/

'The majority of technology professionals are not fully confident they have all the skills needed to manage their environments into the near future, especially when it comes to emerging tech.' [Mar 2019 but still valid]

SolarWinds Finds 75 Percent of Tech Pros Need to Develop Skills to Confidently Manage Environments by 2024; Over 80 Percent Lack Time or Budget to Train
https://www.solarwinds.com/company/press-releases/2019-q1/solarwinds-finds-75-percent-of-tech-pros-need-develop-skills-confidently-manage-environments-by-2024

'And now companies must press forward under a new reality: Technology skills are no longer highly centered in IT; they need to be "marbled" across organizational functions and businesses and coupled with soft skills to achieve transformation success'.

Lack of Skills Threatens Digital Transformation
https://www.gartner.com/smarterwithgartner/lack-of-skills-threatens-digital-transformation/

'8. Technology-centric**.** Organizations should watch out for buying into the hype of the "next big thing." Organizations should instead focus on reinventing their industry with a collection of technological tools. Transformation is never just doing the next big thing. "Aim at unmet needs — the needs of the market and customers that our industry has never served before," Raskino said. "Use the technological tools collectively to invent solutions to do things nobody could do before." '

Avoid These 9 Corporate Digital Business Transformation Mistakes
https://www.gartner.com/smarterwithgartner/avoid-these-9-corporate-digital-business-transformation-mistakes/

'The number of skills required for a single job is increasing by 10% year over year, and over 30% of the skills needed three years ago will soon be irrelevant, according to Gartner TalentNeuron data analysis on millions of job postings. The lack of digital skills is already apparent and the pace of change is leaving HR — and employees — playing catch-up.

"Skills development must be relevant, fast and effective," says Sari Wilde, Managing Vice President, Gartner.' [my underline]

Stop Training Employees in Skills They'll Never Use
https://www.gartner.com/smarterwithgartner/stop-training-employees-in-skills-theyll-never-use/

As a rider, I would add 'don't take on employees who have skills they'll never use or have a very short shelf life'.

> "Digital upskilling is a necessity for everyone. But it is not an end in itself. It is about understanding how to use technology to achieve goals, which usually have nothing to do with the technology itself," says Parkinson.

How to prevent a "digital underclass"?
https://www.raconteur.net/digital-transformation/digital-underclass-skills

The infographic below shows the shortage of cybersecurity skills in the UK; it is here to indicate the size of the shortages across other topics in the computing ecosphere. Whatever the numbers are, they are big and getting bigger, jobs are mutating and new types of job appearing as time progresses.

This amplified the need for the underpinning general IT education to provide a base for the 'shifting sands' of IT. I cannot emphasise this too much.

Cyber Security Skills Gaps [UK]
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/767424/UK_cyber_security_skills_infographic.pdf

The extract and link below support my thesis that cybersecurity skills cannot be effectively obtained from a *standing start* without some other skills and experience.

> 'However, one respondent from a cybersecurity company described CISSP as "the gold standard", on account of the comprehensive grounding that it offers.
>
> "It is a generalist certification, which is a mile wide but an inch deep," they said, "The fact that someone has passed that shows that they have a wide understanding of security and can hold a security conversation with a client."
>
> Furnell says that part of the appeal of CISSP is that it is only available to those with at least five years' career experience. For employers, the simple knowledge that they are hiring a seasoned professional can be at least as valuable as whatever skills that person gained while studying for the qualification.'

How big is the UK's cyber skills gap?
https://www.publictechnology.net/articles/features/how-big-uk%E2%80%99s-cyber-skills-gap

> 'Cybersecurity is a much bigger field than it used to be and now contains a growing number of specialties. Play up the technical skills you already possess because many of them will likely transfer to cybersecurity.
>
> "Today, cybersecurity skills must be built upon disciplines new to security, coupling security with cloud, software development, scripting, automation, infrastructure-as-code, and [the] Internet of Things," [and more I say] says Techstrong's Ashley.'

Companies Going to Greater Lengths to Hire Cybersecurity Staff
https://www.darkreading.com/edge-articles/accelerating-onto-the-on-ramp-for-cybersecurity-jobs

The IT 'durable' skills – PDWs, SLAs, HA etc – are not taught in CS courses.

> "In times of change, learners inherit the Earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists" - *Eric Hoffer*.

Eric Hoffer Quotes

https://www.goodreads.com/author/quotes/9843.Eric_Hoffer

> ‘Specialized IT careers are becoming fewer and more far between because technology is changing so rapidly. While technology innovation created the need for specialists in the first place, faster technology obsolescence means today's technologists have to prioritize learning and be willing to evolve their careers as technologies and their use cases evolve. Also, in the wake of the pandemic, some IT professionals will find their careers disrupted and of those, some will recover faster than others.’
>
> ‘ "One of the best things you can do to prepare yourself is to come up with multiple potential career options," said Jon Hill ..... If you’re flexible and able to adapt to changes as they come, you’ll be better able to weather the uncertainty unscathed and maybe even come out ahead."
>
> Uncertainty is not a new phenomenon. However, it has been exacerbated by the COVID-19 pandemic. Two of the best ways to deal with the uncertainty and rapid technological change are to *broaden one's skills set* so there are more career opportunities to take advantage of and to plan for multiple possible futures and one's value proposition in each.’

IT Careers: Planning Your Future When the Future Is Uncertain
https://www.informationweek.com/strategic-cio/team-building-and-staffing/it-careers-planning-your-future-when-the-future-is-uncertain/a/d-id/1338037

The link below covers a lot of ground in several articles, not all of them new. They emphasise the need for soft skills and debunk the ideas that all computing jobs are about coding and lots of maths is needed.

Softer Skills for a Digital Future
https://media.bitpipe.com/io_10x/io_102267/item_1306461/Focus_softer_skills_for_a_digital_future.pdf

The next two articles are another ‘debunker’ and the titles tell it all.

Degree not needed for IT job/career
https://www.comptia.org/blog/3-things-that-are-more-important-to-it-employers-than-a-college-degree

Why a Skills-Based IT Hiring Approach Can Benefit Your Organization
https://www.comptia.org/blog/why-a-skills-based-it-hiring-approach-can-benefit-your-organization

> ‘The top three specialisms that tech professionals surveyed think are currently needed to succeed in the tech industry remain *general IT skills (39%), cyber security (36%) and cloud (32%)*. However, since 2019, we observed *a rise of 6% of respondents who cited general IT skills* as needed to succeed in the tech industry, suggesting an impact on confidence levels as organisations work from home. This reflects what we’ve witnessed with job applications and job postings across the CWJobs website.’

CWjobs Confidence Index 2020
https://www.cwjobs.co.uk/file/general/cw-conf-index-report.pdf

> ‘Indeed, landing jobs in cloud computing can be harder than it may seem, even as work and life in general have moved to a remote model. That’s due in part to the loosely defined nature of cloud jobs, and partly because working with the cloud requires a

complex mix of skills that you can't typically obtain by getting just one degree or mastering one type of technology.'

'The fact is that many traditional IT educational programs don't train students in this broad selection of skills. A CS degree teaches you primarily how to program. A degree in IT administration or a related field teaches you only IT Ops. And even if you have already been working in industry for a while, chances are that you followed one of these tracks or the other, and may not have the broad skill set that cloud jobs demand.'

This generality applies to data centres as well and I can't think of an environment which requires such broad IT skills as this one.

5 Things to Consider When Searching for Jobs in Cloud Computing [2020]
https://www.itprotoday.com/hybrid-cloud/5-things-consider-when-searching-jobs-cloud-computing

'10. **This is all going to require a different kind of IT perso**n.

No longer will IT be able to depend on a collection of storage guys, networking guys, and server guys who only know their siloed part of the user experience. Instead, IT will need to cross-train its people to understand how various pieces of the company work together, Cappuccio says. That way, they can focus on solving problems rather than pointing fingers.'

What Will the Data Center of 2020 Look Like?
https://www.laserfiche.com/ecmblog/what-will-the-data-center-of-2020-look-like/

'Both Diamond and Gross say that experience trumps all when it comes to moving into cybersecurity and moving up the career ladder within cybersecurity. While cybersecurity education matters a bit, and certifications matter a bit more, being able to point to experience in the field catches the eye of those recruiting for open positions.'

How to Decipher InfoSec Job Titles' Mysteries
https://www.darkreading.com/theedge/how-to-decipher-infosec-job-titles-mysteries/b/d-id/1338471

'Short of telling people to "learn to code", [Tim] O'Reilly sees a new set of literacies being required if the workforce of the future is to take advantage of the oncoming "augmentation" that intelligent systems could enable.

"I think the golden age of the last couple of decades where you can become a programmer and you'll get a job... is sort of over," O'Reilly says. "Programming is now more like being able to read and write. You just have to be able to do it to be able to get the most out of the tools and the environments that you're presented with, whatever they are." '

The unwavering optimism of Tim O'Reilly
https://www.infoworld.com/article/3564824/the-unwavering-optimism-of-tim-oreilly.html

Learn to Code

'There are schemes out there and help is available, which is to be applauded. Yet these are largely siloed and disparate, the product of individual initiative, rather than casting a wide net, and many people will no doubt be left adrift – unsure of how best to proceed with remote learning, or who may not have considered it yet at all, and who will want to do everything they can to somewhat dampen the economic shocks to come.

'Learn to code' has practically become a meme to caricature technocrats who insist that every individual's problem could be solved by a handful of self-paced coding courses, should people only decide to do them.

Crafting apps and designing websites is hardly a one-size-fits-all solution to any of this country's problems. But, what's not in doubt is that there is a digital skills shortage in Britain and throughout Europe.'

The case for universal action on digital re-skilling
https://www.computerworld.com/article/3558728/the-case-for-universal-action-on-digital-re-skilling.html

'According to a hiring report form recruiting software maker iCIMS, while 70 percent of IT staff hires had a bachelor's degree, there's an increase in hiring for IT staff who have no college degree, with a focus on skills rather than education level.

The survey of hiring professionals also found that it's become more difficult to find skilled technology positions that it was just two years ago.

"More technical jobs are emphasizing the need for the skills to perform the duties required by the job, rather than just a college degree alone," Smith says, in what he calls a demand for "new collar" jobs.

"The idea of a new-collar job — that doesn't come with the price tag of an expensive, four-year college degree — allows employees to focus specifically on the skills they need for a role and enables employers to hone in on job qualifications." '

'While skills gap needs in emerging technology is frequently a focus, a lesser-recognized need is for skilled IT workers who understand legacy systems.

Ensono's Harper says 90 percent of the Fortune 500 companies use mainframes, but the staff who know how to run and maintain them are reaching retirement age.

"There is a demand for the mainframe workforce," Harper says. "But the use of cloud has grown exponentially over the last few years, attracting the majority of young talent and leaving Baby Boomers as one of the only generations trained to operate in the mainframe. This becomes a huge hiring problem as those employees start retiring and employers have to fill mainframe roles with millennials who are more interested in careers in cloud computing and other new technologies."

IT skills gap: Facts vs. fiction
https://www.cio.com/article/3309419/it-skills-gap-facts-vs-fictions.html

'Look for people who are adaptable, he says: "IT is ever-evolving and the right individuals won't pigeon hole themselves to the expected capability of a given title. Instead, they will strive to iterate and continue to improve their value to the business. If you've got the right people, who are willing to do what is necessary for the team and organization at large to be successful, then that's more than any founder or CEO can ask for." '

8 IT jobs in flux

https://enterprisersproject.com/article/2020/5/8-it-jobs-in-flux

The link below shows a range of IT skills needed in the area it covers. Few are conered by computer science.

> ‘If you have open source skills, hiring managers want you. Consider fresh open source jobs stats from The Linux Foundation's 2020 State of Enterprise Open Source report.’

Open source IT jobs by the numbers: 13 statistics
https://enterprisersproject.com/article/2020/11/open-source-it-jobs-13-statistics

The next link is a post-Covid-19 article which focusses on skills. One point it makes is that in staff absence, for whatever reason, it becomes apparent whether they have cover skills to help out. This, the article suggest, can be done by reskilling by various means, which is fine.
However, my thesis is that all full-time IT staff should have that general IT underpinning knowledge which can make them a ‘utility’ player in IT support when needed. It makes this role change a lot faster and less disruptive than the methods suggested in the otherwise excellent article.
One suggestion is the use of SKILup days but these are one-day specialised topics, no doubt excellent, but not much use if you are moving more than a ‘few centimeters’ from your current job. Read the rest of the supporting material below.

Should IT Professionals Retrain for a New Normal?
https://www.informationweek.com/strategic-cio/team-building-and-staffing/should-it-professionals-retrain-for-a-new-normal/a/d-id/1338085

> ‘To transform we need not only technical skills: we also need diversity of thought, creativity and an environment that understands risk but is not impeded by it. We need to recruit against our natural tendencies in IT where we traditionally seek specific skills and often don’t describe the personality and people skills that we are seeking.
>
> Recruiting primarily against technical skills is a short-term approach because technology changes rapidly and the skills we recruit today will be out of date very quickly. If we recruit analytical skills and a propensity to learn we are effectively future proofing our team against these inevitable technology changes.’

Research Shows the Skills Shortage s Alive and Well in IT
https://www.ensono.com/uk/blog/research-shows-skills-shortage-alive-and-well-it

> ‘UKCES (2013) forecasts that people with hybrid skill-sets, such as technology and project management skills, are likely to be in demand and workers will need to continue training to develop new skills throughout their careers. Already, different groups are responding to the different opportunities and challenges afforded by technological change in different ways.’

UK tech talent shortage threatens to stifle growth in the industry 14 July 2022]
https://www.bbc.co.uk/news/technology-62098767

> ‘Michelle Donelan, former [UK] education minister, said: "Employers both large and small are crying out for more people to be trained in digital skills.
>
> "An apprenticeship is a fantastic way to achieve that. Not just for young people, but also those looking to upskill."’

Tech skills gap is affecting UK productivity and business resilience [15 July 2022]
https://www.computing.co.uk/news/4053175/tech-skills-gap-affecting-uk-productivity-business-resilience

Speed of Change and Technology

> 'According to Harvey Nash, the most in-demand technical roles for new starters in the UK are:
>
> 1. Infrastructure roles - 32% of all entry level vacancies
> 2. Software engineering roles - 16% of all entry level vacancies
> 3. Data/BI/Analytics roles - 14% of all entry level vacancies.'

These jobs require skills above and beyond coding, algorithms and computational thinking.

Best tech jobs for new starters - Q3 2023
https://www.computing.co.uk/tech-roles-for-new-starters

> 'Despite the hundreds of thousands of students graduating with tech-related degrees every year across the UK, this stream of new educated talent alone is not solving, and cannot solve, the skills gap. This is because tech organisations need skilled talent, rather than just educated talent. And while technology and innovation moves at lightning speed, tech curriculums can take around two years to adapt, meaning they're forever playing catch up. Education typically provides foundational learnings, research theory and general application, yet organisations often require more specific knowledge of tools, technologies, and industry knowledge. This misalignment along with a growing demand for technology skills has contributed significantly to the skills gap we see today.'

Why educated talent alone won't solve the skills gap
https://networkcomputing.co.uk//articles/?article_id=13083&Mag=Network

> 'IT executives surveyed cited talent availability as the main challenge for adopting IT automation (75%) and a significant amount of digital workplace technologies (41%). Lack of talent was cited far more often than other barriers, such as implementation cost (29%) or security risk (7%), according to a statement from Yinuo Geng, research vice president at Gartner.'

Gartner: IT skills shortage hobbles cloud, edge, automation growth
https://www.networkworld.com/article/3633191/gartner-it-skills-shortage-hobbles-cloud-edge-automation-growth.html

> 'Lack of skills remains the biggest barrier to infrastructure modernization initiatives, with many organizations finding they cannot hire outside talent to fill these skills gaps. IT organizations will not succeed unless they prioritize organic skills growth.
>
> I&O leaders must make operations skills growth their highest priority this year.'

Gartner: 4 Trends Shaping Future of Cloud, Data Center and Edge Infrastructure
https://www.apmdigest.com/gartner-4-trends-shaping-future-of-cloud-data-center-and-edge-infrastructure

> 'Infrastructure options have expanded to include alternatives such as hyperconverged infrastructure, cloud resources, and computational storage. Enterprises are looking to support the technologies that are the right fit for the current place and time, Hewitt said. ' ....

> ‘This trend is about keeping things running. IT executives are faced with making sure things work properly and continuously no matter what. They have to support applications no matter where they are. It's kind of a return to an old-school way of thinking: lights-out operations or management, Hewitt said….
>
> ‘Skills requirements are changing due to the evolving infrastructure and operations trends, Hewitt said. One of the biggest changes is a move from the old-school way of developing specific roles, where one person has all the expertise in a particular area, to an emphasis on collective skills. The idea is that you minimize the risk: If one person leaves the operation, you don't lose all of those skills because they are distributed.’

Gartner: COVID-era infrastructure trends you should know about
https://www.networkworld.com/article/3586361/gartner-covid-era-infrastructure-trends-you-should-know-about.html

The new digital learning age [download request]
https://www.thersa.org/discover/publications-and-articles/reports/the-new-digital-learning-age

With one eye on an uncertain future, 80% of businesses state a lack of people skills is holding back their Digital Transformation success [June 2020]
https://www.cloudindustryforum.org/content/lack-people-skills-holding-back-digital-transformation

> ‘The digital skills needed to make everything work are more complex and demanding than ever before, and the sheer number of IT projects being carried out is growing at an unprecedented rate.’

Skills needed to cope with digital transformation they say are:

- ‘Digital transformation strategists and visionaries
- Cloud project management skills
- Technical implementation and hands on skills
- Integration and migration skills
- Security expertise
- Skills in AI and robotic process automation
- Data science skills
- Skills in machine learning
- Infrastructure and operations expertise
- Business consultancy expertise
- Networking expertise.’

They give skill needs %ages for now, in 12 months and in 3 years.

The changing role of the IT department
https://www.cloudindustryforum.org/content/changing-role-it-department

The link below covers the IT skills shortage from a slightly different angle as the title implies. In short, the discussion revolves around:

- Fact: Specialized roles take time to fill
- **Fiction**: Bootcamps are narrowing the talent gap
- Fact: Competition widens the gap
- **Fiction:** Qualified candidates always rise to the surface

- Fact: Soft skills are in demand
- **Fiction**: Firms won't consider candidates without a degree
- Fact: The skills gap affects legacy systems, too
- Fact: Investing in current employees can help close the skills gap

IT skills gap: Facts vs. fictions [sic]
https://www.cio.com/article/3309419/it-skills-gap-facts-vs-fictions.html

> 'Many of us have been told that deep expertise will lead to enhanced credibility, rapid job advancement, and escalating incomes. The alternative of being broad-minded is usually dismissed as dabbling without really adding value.
> But the future may be very different: Breadth of perspective and the ability to connect the proverbial dots (the domain of generalists) is likely to be as important as depth of expertise and the ability to generate dots (the domain of specialists). ……..
> But as the typical mutual fund disclaimer so famously states, past performance is no guarantee of future results. It's time to rethink our love affair with depth. The pendulum between depth and breadth has swung too far in favor of depth.
>
> There's an oft-quoted saying that "to a man with a hammer, everything looks like nails." But what if that man had a hammer, a screwdriver, and a wrench? Might he or she look to see if the flat top had a narrow slit, suggesting the use of a screwdriver? Or perhaps consider the shape of the flat top. Circle? Hexagon? Could a wrench be a more effective tool? And finally, the mere addition of these tools can encourage a better understanding of a problem.'

Harvard lecturer: 'No specific skill will get you ahead in the future'—but this 'way of thinking' will
https://www.cnbc.com/2020/06/15/harvard-yale-researcher-future-success-is-not-a-specific-skill-its-a-type-of-thinking.html

'Challenges and priorities for employers [High Tech, Exhibit 22]

- Attracting (STEM) talent with advanced technical and digital skills
- Promoting culture of lifelong learning, continuous improvement, agility, and innovation, to enable retraining and redeployment of existing workforce toward more productive tasks.
- 'Europe needs to create more training and career pathways Effective training programs, better job matching, and transition support will all be critical to helping individuals chart new career pathways. Over the longer term, every country in Europe needs to ensure that its educational system is preparing students to succeed, with particular emphasis on the abilities required for in-demand jobs, such as STEM skills. Creating partnerships between educators and employers (potentially also involving the government and business associations) could help in the design of career-relevant curricula. Successful models such as Germany's vocational training and apprenticeship system can be replicated on a wider scale.'

The future of work in Europe [June 2020]
https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Future%20of%20Organizations/The%20future%20of%20work%20in%20Europe/MGI-The-future-of-work-in-Europe-discussion-paper.ashx

The 'cloud' is huge part of modern workplace computing but its coverage in CS courses is minimal or zero. The extract below cover the state of cloud computing in mid-2020 along who two major 'players' in its usage. sThe extract not only exposes 'holes' in CS teaching but adds support for my thesis of the need for broad IT training and ongoing refreshing thereof – lifelong learning.

> ***'Microservices/SRE gain momentum***
> Microservices, an architectural and organizational approach to software development that allows developers to build out applications that are easier to update and scale, are rapidly entering the enterprise mainstream. More than half (52%) of the survey's respondents claim they use microservices concepts, tools, or methods for software development. .....
>
> ..... Site reliability engineering (SRE), a software engineering approach to IT operations, is also well on its way to becoming a mainstream methodology. SRE teams use software as a tool to manage systems, solve problems, and automate operations tasks. The study finds that 35% of organizations have already adopted SRE, with 47% of respondents reporting that they expect to implement an SRE function at some point in the future.'

Study: Cloud Migration Gaining Momentum
https://www.informationweek.com/cloud/study-cloud-migration-gaining-momentum/a/d-id/1338135

My online training drive suggestion ties in with the notion that more work will be done from home post-Covid-19 as suggested in the link below. It is all fitting into place nicely and, as Hannibal said in the TV Series *The A-Team*, '*I love it when a plan comes together*'.

> 'IT is constantly evolving so having a static skill set can be career-limiting move. While there's plenty of room for specialists and generalists the only constant in IT is rapid change, so it behooves [*sic*] you to know how things are changing, why and how that could impact your career. .....
>
> Cloud vendors are constantly innovating, so whatever skills you have now are probably very narrow compared to tomorrow's possibilities. In addition to IaaS-related roles, there are many other options including cloud-first application development (platform as a service), AI and machine learning, autonomous systems, robotics, cloud security, serverless architectures, cloud migration, and cloud engineering. .....
>
> There has never been a better time to have a career in IT because there are so many more options than there once were. That said, all career advancement involves learning something, whether it's managing people or how a new technology works. If you love to learn, you've probably won half the battle.'

The IT agility implied in this article does not come with a CS degree but is enhanced by a suitable underpinning IT education and constant learning.

IT Career Paths You May Not Have Considered
https://www.informationweek.com/strategic-cio/team-building-and-staffing/it-career-paths-you-may-not-have-considered/a/d-id/1338199

> 'About two thirds of those in computer programming and IT say they need ongoing training and skills development to get ahead, according to a 2016 Pew study.'

20 ways to kill your IT career (without knowing it)

https://www.cio.com/article/3239287/20-ways-to-kill-your-it-career-without-knowing-it.html

> *Pew Study:* 'Many see personal upgrading as a constant: More than half (54%) of adults in the labor force say it will be essential for them to get training and develop new skills throughout their work life in order to keep up with changes in the workplace. And 35% of workers, including about three-in-ten (27%) adults with at least a bachelor's degree, say they don't have the education and training they need to get ahead at work. ....
>
> The role of college is being debated: While many college graduates with two- or four-year degrees describe their own experience as having a positive impact on them, just 16% of all Americans think that a four-year degree prepares students very well for a well-paying job in today's economy. And there is no consensus regarding the main purpose of college. Roughly a third of adults (35%) say it should be to help individuals grow personally and intellectually, while 50% say it should be to teach job-related skills.'

The State of American Jobs
https://www.pewsocialtrends.org/2016/10/06/the-state-of-american-jobs/

> 'If you're at all involved in the world of IT, it's almost inevitable that you'll run into containers at some point. In many ways, they're the engine that powers the modern web, and the technology is gaining popularity among organisations of all sizes as a tool for developing robust, highly-scalable applications.'

Note the word 'development'; I have never seen it mentioned in any CS curriculum I have studied. Come to think of it, I rarely if ever come across DevOps, applications security and other topic closely linked to 'coding'. I have said that CS does not cover what is needed for workplace for computing, it doesn't even cover application development properly.

The rise of containers
https://www.itpro.co.uk/development/containers/356391/the-rise-of-containers

Cloud computing and digital transformation are the main concerns of companies and will be for some time. The demands for different skills varies as these areas progress and mature and a basic underpinning knowledge is needed before entering this phase of IT evolution.

> 'Technologies are becoming more sophisticated almost by the day, with AI, automation, IoT and many others shaking up the way businesses approach cloud and IT in general. The digital skills needed to make everything work are more complex and demanding than ever before, and the sheer number of IT projects being carried out is growing at an unprecedented rate.'

- Digital transformation strategists and visionaries
- Cloud project management skills
- Technical implementation and hands on skills
- Integration and migration skills
- Security expertise
- Skills in AI and robotic process automation
- Data science skills
- Skills in machine learning Infrastructure and operations expertise
- Business consultancy expertise
- Networking expertise

The changing role of the IT department [download link]
https://www.cloudindustryforum.org/content/changing-role-it-department

The extracts below address the area of STEM (Science, Technology, Engineering and Mathematics) but I believe that its 'synergy' theme applies to are world of computing.

> 'This multidisciplinary approach was seen as being vital for all students to be successful participants in society. This approach would prepare students to solve interdisciplinary problems that they would encounter in the global society regardless of their major or chosen career path. STEM education would prepare students of all ages to become critical and creative thinkers, innovators, problem-solvers, collaborators, and strong communicators. .....
>
> 'STEM literacy is a foundational skill that matters for all careers, not just STEM-related fields or jobs. This multi-skilled, STEM educated individual is a representation of a student who understands how academic subjects are meant to be a genuine symphony and not a collection of discordant solos.'

NICE 2020 Spring eNewsletter
https://www.nist.gov/itl/applied-cybersecurity/nice/nice-2020-spring-enewsletter#Academic%20Spotlight

> ' "The jobs aren't the same as two or three years ago," he acknowledges. "The types of skill sets employers are looking for is evolving rapidly." .....
> The next trend is cloud computing. With more organizations putting their workloads in public and private clouds, they've become less interested in hardware expertise and want people who understand the tech's complex IT infrastructure. .....
> A bigger focus on business resiliency is the third major trend. The know-how needed here emphasizes technologies that make a network more intelligent and enable it to learn how to protect itself. Think: automation, artificial intelligence, and machine learning.'

Security Jobs with a Future -- And Ones on the Way Out
https://www.darkreading.com/edge/theedge/security-jobs-with-a-future----and-ones-on-the-way-out/b/d-id/1338652

If the summary below doesn't point to a broad underpinning IT training path, with continuous (lifelong) learning, I don't know what does.

> 'The skills we need, and the ones we have, change constantly. Because things change constantly.
>
> - Our jobs change and our careers grow
> - Rules and regulations get implemented
> - Customers' values and behaviors evolve
> - New technologies create new possibilities
> - Business strategies shift and priorities shuffle.'

The State of Skills 2021:
https://get.degreed.com/hubfs/State%20of%20Skills%20PDFs%20Dec%202020/The%20State%20of%20Skills_digital_111920.pdf

> 'There is some evidence that there is a gap between today's graduates and the skills expected by employers .....

What needs t happen is that industry and academia need to begin to speak the same language to the extent possible.'

Computing Curricula 2020 CC2020 Paradigms for Future Computing Curricula Version 44

https://cc2020.nsparc.msstate.edu/wp-content/uploads/2020/11/Computing-Curricula-Report.pdf

'One reason fueling the transition from the KA [*knowledge areas*]-KU [*knowledge units*]-LO [*learning outcomes*] model to *competency-based* specification is the skills gap that exists between the needs of industry and the capabilities of graduates from computing programs (Radermacher et al. 2014). From any typical university, an overwhelming percent of computing graduates enter the workplace. While universities are not training grounds for industry, including arguments that industry expectations are unrealistic (Clear 2015), there is an obvious benefit in aligning baccalaureate graduates in computing with the needs of industry.'

'As technology changes, the companies and organisations using it have to change, too, in order to remain competitive. A Microsoft study from 2020 (*) found that 80% of UK leaders believe investment in digital skills will be important to the country's economic recovery following COVID-19, while 78% also view a large pool of digital talent as essential to driving UK competitiveness. However, more than two-thirds (69%) of UK business leaders believe their organisation is currently facing a digital skills gap, exposing the country to the risk of being left behind as technology changes the world's economies.'

Universities: we can't close the UK's digital skills gap on our own [Nov. 2021]
https://news.microsoft.com/en-gb/2021/11/17/universities-we-cant-solve-the-uks-digital-skills-gap-on-our-own/

(*) *UK's digital skills gap poses risk to economic recovery, research reveals* [Nov. 2020]
https://news.microsoft.com/en-gb/2020/11/23/uks-digital-skills-gap-poses-risk-to-economic-recovery-research-reveals/

The link below points to a n Uptime Institute study of data centres in 2021. One skills related figure is that 48% of those interviewed had 'difficulty in finding suitable candidates for open jobs'.

Uptime Institute Global Data Center Survey 2021
https://uptimeinstitute.com/uptime_assets/4d10650a2a92c06a10e2c70e320498710fed2ef3b402aa82fe7946fae3887055-2021-data-center-industry-survey.pdf

'This means a career in IT is no longer just about developing specialist technical skills. Candidates want to develop a broader knowledge of how an enterprise works and of IT's role in driving a business forward.' [*Case supported*]

"If CIOs want to attract these candidates, they must demonstrate that they can offer immersive experiences that enable employees to collaborate with a wide range of expert colleagues – drawn not only from IT, but from all parts of the business," Gopalan says. [*Not possible if you are a Willy/Wendy Oneskill*]

"Your employer value proposition is the key to retaining talent, with opportunities that promise a rewarding future in the organisation," he stresses. [*Not 30 years in one job*]

How to retain IT talent amid the great resignation

https://www.raconteur.net/hr/talent-management/how-to-retain-it-talent-amid-the-great-resignation/

> 'For workers, the state of skills study 2021 from Degreed, concludes that 41% of UK workers believe their core job skills will be obsolete within five years. Taking a proactive approach to learning new skills will be vital if they want to ensure their skills remain relevant and in demand.'

https://www.itpro.co.uk/business-strategy/careers-training/358740/what-are-your-tech-skills-worth

https://www.hays.co.uk/salary-guide/

> '"To be totally honest, you come out of a university degree in computer science scratching the surface of what you're going to do as a job. And particularly as you proceed, as you grow to higher levels, you move from technical proficiency into a whole bunch of other aspects of what the job entails. I mean, we were joking before we started that the one thing I definitely do not do now is write code as CTO. So the kinds of mental tools that you need to have can be very, very different as you proceed through the levels of software engineering. And so the technical proficiency, honestly, you could pick up a lot of different ways." '

This podcast says just what I have been saying, especially regarding the volatility of IT and the static nature of computer degrees.

The IT Pro Podcast: Do degrees make better developers?
https://www.itpro.co.uk/software/development/367069/the-it-pro-podcast-do-degrees-make-better-developers

https://www.itpro.co.uk/development/software-development/367070/podcast-transcript-do-degrees-make-better-developers [Transcript of the above podcast]

> 'The savviest organizations are taking on the onus of training talent themselves, increasingly hiring people straight out of school, according to Jean-Marc Laouchez, president of the Korn Ferry Institute. These firms are also trying to instill a culture of continuous learning and training.
>
> "Constant learning — driven by both workers and organizations — will be central to the future of work, extending far beyond the traditional definition of learning and development," Laouchez wrote.'

How tech companies are responding to the talent gap
https://www.computerworld.com/article/3664116/how-tech-companies-are-responding-to-the-talent-gap.html

> 'Job descriptions can be tricky. Many conventional job titles have become outdated in certain workplace contexts. The modern workplace doesn't represent the rigid professional boundaries between co-workers and their respective responsibilities seen in job descriptions. Today's employees are often required to collaborate across the board. And given the rapid pace of tech advancements, engaged employees are also constantly acquiring new skills and crossing previously well-defined lines to boost productivity and work quality.'

It's Time to Rethink Job Descriptions for the Digital Era [download request]

https://enterprisersproject.com/it-s-time-rethink-job-descriptions-digital-era

The article link is below.
https://enterprisersproject.com/sites/default/files/2022-03/its-time-to-rethink-job-descriptions-for-the-digital-era.pdf

> 'As data centers [and cloud] evolve, the skills needed to run them change as well, creating both a challenge and opportunity for current data center workers.'

9 hot jobs in the evolving data center
Data-center pros looking to ride technology waves toward more secure careers need both technical and people skills.

- Hybrid Solutions Architect
- Director of Operations
- Application Platform Engineer
- Public-Policy Program Manager
- Strategy Program Manager
- Director of Network and Connectivity
- IT Hardware Manager
- Data Science Specialist
- SOAR Engineer [Security, Orchestration, Automation, and Response]

Below are two more examples of *specialist jobs* whose different species point to needing a general IT education.

1. *Cloud Specialist*

'Sample education requirements**:** Bachelor's degree in computer science or information technology. Because this position often requires managerial skills, a Master of Business Administration (MBA) degree might lead to additional clients.'

[So, you think you can get there from a standing, no pre-requisites start!!!]

1. Cloud administrator
2. Cloud security analyst
3. Cloud network engineer
4. Cloud automation engineer
5. Cloud consultant
6. Cloud software engineer
7. Cloud engineer
8. Cloud architect

Top 8 cloud computing careers of 2022 and how to get started

https://www.techtarget.com/whatis/feature/Top-7-cloud-computing-careers-and-how-to-get-started

2. *Cybersecurity Specialist*

1. Chief information security officer (CISO)
2. Cybersecurity architect
3. Security engineer
4. Security analyst

5. Incident response coordinator
6. Cybersecurity consultant
7. Security awareness trainer
8. Vulnerability management specialist
9. Cybersecurity project manager
10. Information Security Manager
11. Penetration tester
12. Ethical hackers

Cybersecurity is a growing field with different job roles

The roles outlined above are just the hottest ones; as the threat landscape evolves, new cybersecurity positions will likely emerge. With the right skills and experience, you can launch a successful career in this exciting and important field.

Hottest cybersecurity jobs of 2022

https://www.techrepublic.com/article/hottest-cybersecurity-jobs/

Note: I suspect these (and many other terms) do not appear in CS courses. Next year, these may well change but CS curricula won't.

https://www.networkworld.com/article/3655744/9-hot-jobs-in-the-evolving-data-center.html

> 'Today's employees are often required to work with other teams and offer expertise outside the confines of their department while still carrying out specific duties outlined in their job description....
>
> With the increasing support of technology and digital transformation, today's most engaged employees are also constantly acquiring new skills and crossing previously well-defined lines to boost productivity and work quality.'

It's Time to Rethink Job Descriptions for the Digital Era
https://hbr.org/2021/12/its-time-to-rethink-job-descriptions-for-the-digital-era

> 'First, we need practical, hands-on technical skills, where we are actually doing the job or completing the task. This is the "experience" part of the job listing that we always notice. This practical technical knowledge can include anything from the ability to configure a network to the ability to penetration test a system to the ability to install a firewall. The specific skills in this area vary greatly from job to job, and are growing in quantity as the number of security threats, software programs, and technology platforms included in cybersecurity continue to grow.'

7 Must-Have Skills for Cybersecurity Success
https://startacybercareer.com/six-skills-needed-for-success-in-cyber-security/

> 'In the first quarter of 2022, skills centered around "management, methodology, and process" were the most richly-rewarded, buoyed by demand for skills such as AIops, Azure Key Vault, big data analytics, complex event processing/event correlation, deep learning, DevSecOps, Google TensorFlow, MLOps, prescriptive analytics, PyTorch, Scaled Agile Framework (SAFe), security architecture and models, and site reliability

engineering (SRE), almost all of which continued to grow in value. (Among them, only TensorFlow and SRE fell.)

This list will doubtless be different in 2023, 2024,……, further telling of the need for a solid general IT background. Sir Isaac Newton once said; '*If I have seen further than others, it is only by standing on the shoulders of giants*.' In the IT world, those 'shoulders' are the general IT base knowledge.

'Recent layoffs at massive tech firms have prompted talk of the technology bubble bursting, when it is more like the Silicon Valley bubble. The technology market remains strong, as seen in the shortage of skilled employees - a shortage that will only continue to grow more pronounced next year' [2023].

Demand for tech workers will remain high, but the talent shortage will get worse

https://www.computing.co.uk/special/4061521/computings-tech-predictions-2023

Pay for in-demand IT skills rises fastest in 14 years

https://www.cio.com/article/350363/pay-for-in-demand-it-skills-rises-fastest-in-14-years.html

The survey below was sponsored by Skillstx – an eye opener.

- 71% of CIOs report skills gaps will affect their business
- 75% of organisations will experience visible business disruption caused by skills gaps
- 70% of employees have not mastered the skills they need for their jobs today
- 60% of employees do not have the skills needed for their current and future roles
- 51% employees are looking for a new job
- The #1 risk facing organisations is talent shortage
- Only 2 in 10 organisations are taking tangible action with 100% recognising they need to.

https://youtu.be/yUnra6YHy_I [video]

https://youtu.be/yUnra6YHy_I?t=996 [video section with this list]

A Good Roundup - Not Mine

Rather than take extracts from the paper below and reproduce them here, I would ask you to read it in full – it isn't a lot of reading. The key thing about the paper is that it supports most of the things I have been saying about IT education and IT careers; both move and mutate at speed. Had I discovered it earlier, it would have saved me a lot of research and writing,

IT Careers: 10 Things IT Leaders Would Tell Their Kids Today
https://www.informationweek.com/it-life/it-careers-10-things-it-leaders-would-tell-their-kids-today

No Specialism is an Island.

'Additional Job Roles Interacting with IBM Cloud

Some of these job roles include, but are not limited to, cloud network engineer, cloud data center specialist, test specialist - cloud applications, the folks that work with the

DevOps team, including senior UX design leads, cloud product manager, cloud administrator, and cloud incident management and operation roles.'

Job Roles That Support Cloud
https://learn.ibm.com/mod/scorm/player.php?a=4546&currentorg=articulate_rise&scoid=55533

The link below has list of several cybersecurity jobs but hints at job mutation, even in a specific specialisation like cybersecurity. Which direction? When? What sort of shift – gentle or tectonic? The only safe platform to launch into such a career is a general IT grounding, kept up to date.

12 most in-demand cybersecurity jobs in 2022
https://www.techrepublic.com/article/hottest-cybersecurity-jobs/

From a Business Perspective
The greatest needs for business from CIOs. Do these needs not cry out for general skills, IT and business, perhaps alongside specialist skills?

1. Increasing cybersecurity protections: 49%
2. Increasing operational efficiency: 46%
3. Improving customer experience: 42%
4. Transforming existing business processes (i.e., automation, integration): 41%
5. Improving employee productivity: 27%
6. Improving profitability: 24%
7. New product development: 22%
8. Enhancing hybrid work technologies: 21%
9. Increasing top line revenue for the business: 20%
10. Meeting compliance requirements: 19%

Top 10 business needs driving IT spend
https://www.cio.com/article/309753/top-10-business-needs-driving-it-spending-today.html

The link below, although a few years old, is testimony to the volatility of technology, jobs and company IT personnel requirements. This situation cannot be handled by static education and books. For a summary, read page 4. 'Executive Summary' and read the words you will also read in newer reports today and tomorrow.

The Digital Talent Gap
https://www.capgemini.com/wp-content/uploads/2017/10/dti_the-digital-talent-gap_20171109.pdf

'Talent & skills
For the UK, it is estimated by the UK Commission for Employment and Skills, some 518,000 additional workers will be needed to fill the roles available for the three highest skilled occupational groups in the digital sector by 2022. This is three times the number of computer science graduates this nation has produced in the past decade[footnote

1] At the same time, current approaches to immigration and hiring fall short of meeting this demand for a diverse and inclusive tech workforce. Given the strong international competition for the same pools of talent, this is a fundamental barrier to current aspirations and any hopes of future success.'

UK Tech Competitiveness Study [October 2020]
https://www.gov.uk/government/publications/uk-tech-competitiveness-study/uk-tech-competitiveness-study

Thinking in Money and Advancement Terms

If you still think coding is the way ahead for you, then look at the U.S. salary figures below, extracted from the link under the table and normalised to SRE=100.

Programmer	59
IT operations engineer	60
Software developer	75
DevOps engineer	80
Software engineer	84
Security engineer	87
Software development engineer	90
Site reliability engineer (SRE)	100

The index '100' is just short of $140,000 p.a.

New Report Details Impact of Site Reliability Engineering on ITOps

https://www.itprotoday.com/it-operations/new-report-details-impact-site-reliability-engineering-itops

What does this all mean? It asks the question; *'Where would you sit in this table just knowing how to code in Python (or any other language)?* All the other disciplines, especially the ones lower in the table, need a much broader knowledge of IT which, as I have laid out *ad nauseam*, is not covered by any course whose curricula I have had the time to study. There have been many.

Support for the table above can be found at:
IT Career Development in 2022: Top Stories So Far
https://www.itprotoday.com/career-development/it-career-development-2022-top-stories-so-far

The actual jobs and salaries are not exactly the same but the same principle of

job needing general IT knowledge = biggest bucks

applies. Q.E.D. a far as I am concerned.

... and there's more in the table below and its source document!

Aligning business and technology goals	58%
Collaborating with internal stakeholders	58%
Interacting with customers	47%
Securing data and applications	42%
Building vendor relationships	40%
Experimenting with cutting-edge technology	40%
Preparing reports	39%
Managing vendors	38%

Cyber risk management	38%
Managing network and systems infrastructure	37%
Data infrastructure	37%
Data management	35%
Supporting desktops and user applications	33%
Data governance and privacy	32%
Analyzing, integrating, normalizing, or cleansing data	31%
Integrating enterprise applications	30%
Cyber resilience and business continuity	28% [1]
Leadership development	28%
Building project teams	27%
Developing/programming applications	**27%** [2]
Seeking out new business opportunities	15%

TABLE 1: CRITICAL BUSINESS AND TECHNICAL SKILLS

This table is a reproduction of Figure 17 in the report link below

[1] I think this rating is grossly underrated – no working system = no business.

[2] This puts a real perspective on current education's obsession with 'coding'.

US IT Salary Report: A Shifting Job Market for Tech Talent [2022]

https://networkcomputing.tradepub.com/?p=w_defa2585&w [download request]

https://networkcomputing.tradepub.com/?p=w_defa2585&w=d&email=36d5d934825c41283fc0e9c68846524d&key=sfwXEDeLONwVMYda5VTf&ts=11529&u=08615401319316610114 75&e=dGNyaXRjaGxleTA3QGdtYWlsLmNvbQ==&secure=1&_afn=0 [the report]

In addition, in Figure 18, the top skills given as necessary for advancement was '*Training on new technologies'*. If you didn't have grasp of the '*old technologies'*, this is a big ask. This, and several others in the list, e.g. *containers* and *enterprise architecture*, support my thesis of the need for *General IT Training* to the hilt.

Kubernetes, Where Art Thou?

In the links below, Kubernetes and containers are shown as being used widely and getting more popular. Try to find this subject covered in any current computing education, especially the top universities' computer science [static] curricula.

Where are Containers and Kubernetes in Current IT Training?

> 'For container adoption [See chart in link below], nearly half, or 47% of respondents, said they're running containers in production workloads, with another 37% running containers for development only. Of the 16% that aren't running containers at all, the majority of those respondents said they're evaluating the technology '

Red Hat's 2021 Open Source Survey: Who's Using the Software and Why
https://www.itprotoday.com/hybrid-cloud/red-hats-2021-open-source-survey-whos-using-software-and-why

Nowhere according to my curricula research.

> 'Kubernetes may not be perfect, but there's no denying that a lot of people love it. Indeed, Kubernetes provides orchestration for more than three-quarters of containerized applications today.'

4 Reasons Why Kubernetes Is So Popular

https://www.itprotoday.com/hybrid-cloud/4-reasons-why-kubernetes-so-popular
'For workers, the state of skills study 2021 from Degreed, concludes that 41% of UK workers believe their core job skills will be obsolete within five years. Taking a proactive approach to learning new skills will be vital if they want to ensure their skills remain relevant and in demand.'

https://www.itpro.co.uk/business-strategy/careers-training/358740/what-are-your-tech-skills-worth

https://www.hays.co.uk/salary-guide/

No Pre-requisites Required!
The example below is typical of almost all specialist courses I have come across in my study of their curricula,
'No prerequisites are required.'
Cybersecurity
https://www.coursera.org/mastertrack/cybersecurity-asu
In the rapidly evolving IT world and the jobs within it, this is quite nonsensical in my view.
A more sensible view of the fact that cybersecurity (and most other specialisations) are not detached from the rest of the IT universe follows;

> 'Plus, if you choose this path, you'll always have room to grow. You'll continually be learning new skills and working to understand new technologies. New challenges will keep popping up and you'll be exposed to a multitude of new people, situations, and opportunities.'

4 reasons to consider a cybersecurity career
https://content.microfocus.com/careers-tb-tc/cybersecurity-careers-tb/why-cybersecurity-career

UK workforce is "unprepared and unskilled"

> 'The reason[s] for these failures are depressingly familiar: a dearth of digital know-how and understanding among government's senior non-specialist leadership; embedded legacy systems stymieing the drive to digitise services; a lack of requisite management structures; a continued overdependence on outsourcing; and a scarcity of the required skills in both public and private sectors.'

Public Accounts Committee: government IT is 'dysfunctional, damaging and sometimes dangerous'
https://www.computing.co.uk/news/4041909/public-accounts-committee-government-dysfunctional-damaging-dangerous

'When comparing age categories, 33% of 18-24 said they were passionate about their work, a notable difference from the 47% of 25-55+ year olds that responded the same way.
.....
The results highlight a pressing need for adequate training and development programmes – but 66% of respondents said they felt their training was not relevant to their role. Around 13% of respondents even said that their training was "random and unplanned", Questionmark found. .....

Questionmark has urged organisations to refresh their training schemes and introduce a cycle of new programmes [what I am preaching], which should also provide opportunities for staff to test their skills in practical scenarios [for example apprenticeships] .'

UK workforce is "unprepared and unskilled" for future of work, survey finds
https://www.itpro.co.uk/business-strategy/careers-training/367784/uk-workforce-unprepared-unskilled-for-future-of-work

A Final Whammy

General IT competence is need to optimise ***any*** IT specialisation. Most specialisations have boundaries far wider than their title suggests and cybersecurity is shown in all its width and depth in the diagram below.

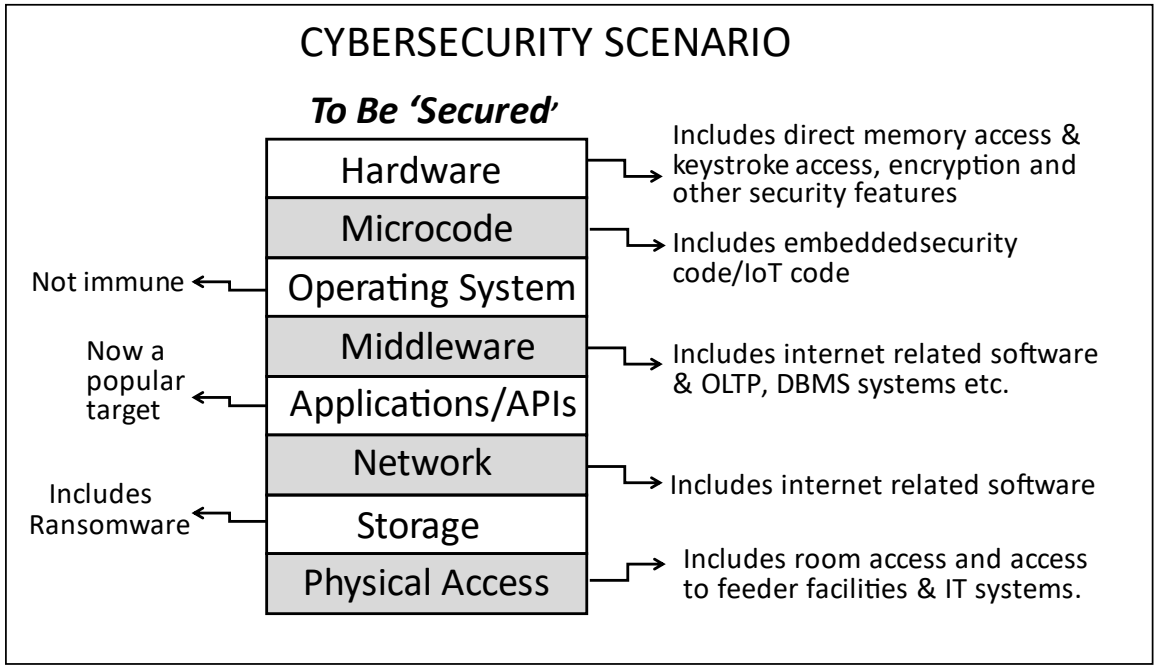


FIGURE 5: WHERE CYBER 'LIGHTNING' STRIKES

The diagram above (figure 2) is an overview of where the cyber 'lightning' can strike and cause damage. In the light of the diagram, please show me how anyone can become a cybersecurity specialist without a broad, general IT knowledge. Job specs should actually spell out which TYPE of cybersecurity person the organisation wants although I suspect the job 'specifiers' have never seen the diagram above.

Cybersecurity: Singular or Plural?

The link below outlines the different roles in the cybersecurity field, how you might get into those roles and other items which need to be understood. What it illustrates is that there is no such job or career as simply 'Cybersecurity' and that there are stepping stones to get there from other jobs in IT as well as degrees in computer science.

Cyber Security Jobs
https://www.acumin.co.uk/jobs/cyber-security-jobs/

The next link outlines colourful variations on cybersecurity roles, complementing the link above and what I said about it.
Coolest Careers in Cyber

Organizations are hiring individuals with a unique set of skills and capabilities, and seek those who have the abilities and knowledge to fulfill many new job roles in the cybersecurity industry. The coolest careers in cybersecurity are the most in-demand by employers. Which jobs are the coolest and most in-demand? We know; let us show you the hottest cybersecurity jobs for 2022.

https://assets.contentstack.io/v3/assets/blt36c2e63521272fdc/blt6b6beaf55a366a55/Poster_Coolest-Careers_v0322.pdf

You might instructively compare any computer science (CS) curriculum with this diagram plus everything else I have outlined relating to workplace skills above. CS has its place, I'm sure, but it is not the solution to the workplace IT skills problem.

What is said about cybersecurity jobs could equally apply to the Cloud scenario and other 'shiny new' jobs in IT.

'There are more things in heaven and earth [IT]*, Horatio, than are dreamt of in your philosophy'* [CS]. [Hamlet]

Those words define what I have tried to do at great length above to demonstrate that ANYONE in IT, at whatever level, needs an underpinning, general knowledge of the subject at the appropriate level of detail. This includes non-IT executives and managers as their IT-informed business input to IT projects in vital.

Summary Of 'Reasons'.

The overwhelming evidence I present above makes the case for general IT training better than I could myself. I'd love to see counter-evidence to the many pages of extracts form many papers and people which I have presented in the last 20 or so pages.

There are many numbers demonstrating the size of the skills gap and average out at about 2/3 of the skills needed. In short, business is running with only 1/3 tank of 'gas'; how far before it stalls?

'The "Gap" between business expectations and IT delivery has never been worse

The gap between what business units expect and what IT can deliver continues to widen, as tracked for the past five years in this project. For 2022, in United Kingdom and Ireland:

- 79% of IT leaders believe their organizations have an "availability gap" between the SLAs expected and how quickly IT can return to productivity.
- 79% of IT leaders believe their organizations have a "protection gap" between how much data they can afford to lose and how often data is protected.

The rationale for these gaps is most likely due to the rising criticality of more workloads. But there is an obvious corollary between the top change drivers of improving RTO (availability), RPO (protection) and reliability (Figure 1.3 in the report) — versus these perceived "gaps." The perception gaps by IT leaders and the change drivers for IT implementers around reduced data loss and downtime is even more justified when considering that 40% of servers (globally) suffer at least one outage per year.'

Top Trends in Data Protection 2022 [executive]
Data Protection Trends Report 2022 [full report]
https://www.veeam.com/2022-data-protection-trends-report_wpp.pdf

Try to find RTO and RPO and their environment in any computer course syllabus you can name. I have found only one: UK BTEC 3. It also covers service level agreements (SLAs), disaster recovery, [high] availability and a few other topics key to modern IT and that I have not found elsewhere in all my curriculum studies.

I am reluctant to say this but I would sooner study BTEC 3 than spend 3 years at university studying computer science which never broaches these topics, vital in modern, workplace IT.

Pearson BTEC Nationals in Computing [308 pages!]
https://qualifications.pearson.com/content/dam/pdf/BTEC-Nationals/computing/2016/teaching-and-learning/BTEC-Delivery-Guide.pdf

Apprenticeships as a University Alternative

I maintain that a phased tuition/apprenticeship, suitably configured, is a better bet for entering the pragmatic world of workplace computing. The general IT training I am suggesting does not contain the topic of coding. This can be done via a coding bootcamp, depending in which language is needed in the company supporting the apprenticeship. There are 10 most often used languages extant and it would be silly to include all in a general IT course. See the links and quotations below.

> "That is why we are taking action to crack down on rip-off university courses, while boosting skills training and apprenticeships provision.
>
> "This will help more young people to choose the path that is right to help them reach their potential and grow our economy."

Rishi Sunak, UK Prime Minister. Mid-July, 2023

> 'A new study shows employers are ending college degree requirements for many job openings, focusing instead on skills, experience, and personality traits. The sea change opens up tech jobs to a more diverse pool of candidates.' ...
>
> 'By eliminating unnecessary and outdated degree requirements, employers open themselves up to a larger talent pool of would-be hires with skills learned through on-the-job training, boot camps, and certificate programs.' [August 2022]

Companies move to drop college degree requirements for new hires, focus on skills
https://www.computerworld.com/article/3669412/companies-move-to-drop-college-degree-requirements-for-new-hires-focus-on-skills.html

> 'Apprenticeships are meant to teach people skills they need for work without incurring a mountain of debt. [UK, 3 Years £27,000 + living, US up to $53,000] .....
>
> Since 2013, the number of apprentices tracked by the Department of Labor has doubled to 437,083 last year. Meanwhile, nationwide, undergraduate college enrollment dropped 8% from 2019 to 2022, with declines even after students returned to in-person classes, according to data from the National Student Clearinghouse.' .....
>
> ' "The education-to-employment system fails for most employers and young people," it said. "Examples of positive outcomes in education to employment are the exception rather than the rule." '

Is it possible to avoid student debt? These career, education tracks offer a different path

https://eu.usatoday.com/story/money/personalfinance/2023/03/15/student-debt-different-education-career-path/11415757002/

> 'In the job market, skills are the new degrees....'

> ‘Companies that prioritize skills over “antiquated signals” like a degree or pedigree “will help ensure that the right people can be in the right roles, with the right skills, doing the best work,” Roslansky said. “It’s going to create a much more efficient, equitable labor market, which then creates better opportunities for all.” ‘
>
> ‘Rometty told Fortune CEO Alan Murray that hires without college degrees performed just as well as Ph.D. holders from top universities.
>
> And Accenture launched an apprenticeship program aimed at funneling non-degree-holding workers into its talent pipeline in 2016.’

LinkedIn’s CEO says skills are replacing a college degree in this job market
https://fortune-com.cdn.ampproject.org/c/s/fortune.com/2022/11/23/skills-replacing-college-degrees-hiring-linkedin-ceo-ryan-roslansky/amp/

> 'The program is rigorous. Students spend the first six months receiving training for soft skills and technical skills. Once trained, they spend the next six months working as an intern for their corporate sponsor. Throughout the internship, students are given regular feedback and meet with other interns and career advisors weekly to review their progress and go over any additional training they might need.

How Year Up is redefining and diversifying the IT talent pipeline
https://www.cio.com/article/190954/how-year-up-is-redefining-and-diversifying-the-it-talent-pipeline.html

> ‘A 2020 study by Gartner [* below] indicated that employees apply only 37% of the new skills they learn through traditional training. The same study showed skills also have a limited shelf life; 33% of the skills needed three years ago are no longer relevant today.
>
> “The traditional degree is made up by a boatload of information you hardly ever use, and because you’re learning for three years without using those skills, you’re falling further behind as state-of-art technology is moving ahead all time,” Graham said.
>
> When education is matched to a job where the lessons can be readily applied, both talent goals and business outcomes rise sharply, Graham said — nearly 10-fold.’

The new way to hire tech workers: from the bottom up
https://www.computerworld.com/article/3681651/the-new-way-to-hire-tech-workers-from-the-bottom-up.html

[*] https://www.gartner.com/en/newsroom/press-releases/2020-08-19-gartner-hr-research-finds-employees-are-only-applying-54-percent-of-newly-learned-skills

> A tech-based generation gap. Despite being digital natives, members of Gen Z entering the workforce report that they lack critical tech skills. More than half of Gen Zers say that they received very little (or no) instruction in digital skills, per a survey of about 15,000 adults. An existing education gap between lower-income and affluent students means many Gen Zers are falling behind. Even as companies invest in automation and other digital tools, they often lack the training resources necessary to get workers up to speed. This has left many Gen Zers suffering from “tech shame.” [*Fortune* magazine February 2, 2023 at 2:00 PM GMT]

America is failing to prepare Gen Z to enter the workforce due to a ‘glaring’ gap in tech skills

> **“Prepare for the future war for talent**

- Rethink hiring to reduce focus on credentials and instead value experience.
- Invest in on-the-job training and rotation programs that build your talent bench.
- Expand policies on childcare, elder care, and parental leave to retain top talent."

Partner with public- and social-sector organizations to reskill workers at scale.

A productivity agenda for CEOs

https://www.mckinsey.com/mgi/our-research/rekindling-us-productivity-for-a-new-era

> 'There are a number of reasons why someone might take either a computer science degree or a coding bootcamp. For price and convenience, bootcamps generally have the edge. There is also a strong argument for bootcamps as a factor for driving employability, with hiring statistics painting a good picture of the quality of skills one might learn at a coding bootcamp.'

Coding bootcamp vs computer science degree: Which is best for a career in tech?
https://www.itpro.co.uk/business-strategy/careers-training/368564/coding-bootcamp-vs-computer-science-degree-which-is-best

Universities call for a tuition fee rise [Sept. 2022]
https://theconversation.com/universities-call-for-a-tuition-fee-rise-heres-what-that-would-mean-for-students-and-taxpayers-189423

Who says we need alternatives? Lots of people. My own thoughts on this envisage the sequence of this as;

1. IT Introduction course
2. Period with a company – phase 1 of apprenticeship
3. More advanced IT course
4. Second company assignment – phase 2 of apprenticeship
5. Specialisation training, possibly at a company's behest.

I think this sequence might take 12-18 months and produce a better finished article than a university course in terms of survival in the IT battlefield.

How to break down barriers to tech careers
From second career opportunities to apprenticeships, how can alternative paths into tech help diversify and grow the talent pool?
https://www.raconteur.net/sponsored/work-rewired/how-to-break-down-barriers-to-tech-careers/

National Apprenticeships Week 2022 [UK]
https://www.apprenticeships.gov.uk/influencers/naw-2022#

> '72% of young adults with degrees believe college didn't fully equip them to start their career, with many citing a lack of work experience and applied learning opportunities as the missing elements.
>
> Young adults crave workforce experience - 6 in 10 young adults believe it's the most crucial element to prepare for a successful career. Nearly half of all young adults say they were expected to go to college after graduating high school, but three-fourths would skip college if their dream job was attainable without a degree.
>
> Apprenticeships can plug the biggest gaps between education and careers. Apprentices rated applied learning, learning industry specific knowledge and gaining real workforce experience as the top benefits.

> Apprenticeships can lead to high retention rates amongst early talent - 93% of apprentices plan to stay in their chosen industry.'

Professional Apprenticeships

https://info.multiverse.io/hubfs/US%20Professional%20Apprenticeships%20Report/Multiverse%20Professional%20Apprenticeships%20Report.pdf

In addition, there are a number of UK companies handling apprenticeships; Multiverse, Firebrand, Optionis and others. So far, my appeals to them to cooperate in this plan has fallen on deaf ears (5.9.2022).

> *'Strengthen coaching, particularly early in an employee's tenure.* A great deal of skills development happens day to day on the job. Coaching and apprenticeship can maximize this effect.'

Human capital at work: The value of experience [June 2022]
https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/human-capital-at-work-the-value-of-experience

> 'As such, it is a responsibility of employers, hiring organisations, individuals and support organisations to raise awareness, promote upskilling and in work training, and open doors to those with less experience in tech to pave the way to a brighter tech future for all.'

The link below says, in its own words, that the on-the-job training is desirable, rather like an apprenticeship, than training in isolation from the workplace.

> *'Integrating training and daily work reinforces employee benefits*
> In order to minimize overall investment and maximize return, companies are keeping employees on the job while training rather than adding travel and large blocks of time off to the overall cost of training (see Figure 5). This coincides with a growing training trend of integrating training into the daily practice of the professional rather than treating it as a separate exercise that might or might not have an immediate bearing on the employees' daily work.'

The Myths of Training Cybersecurity Professionals [download link]
https://www.informationweek.com/whitepaper/team-building-and-staffing/cybersecurity/the-myths-of-training-cybersecurity-professionals/443360

> *People and Skills Report 2022*

https://technation.io/people-and-skills-report-2022/#conclusions

The case for apprenticeships coupled with interspersed learning is strong and getting stronger. The people cited above can't all be wrong.

To Continue …
Toward the visual understanding of computing curricula
https://link.springer.com/article/10.1007%2Fs10639-020-10127-1

I believe that in the diagram below, 'Competence' refers to what I call pragmatic information technology. CS provides knowledge only and much of that is superfluous to what the workplace needs.

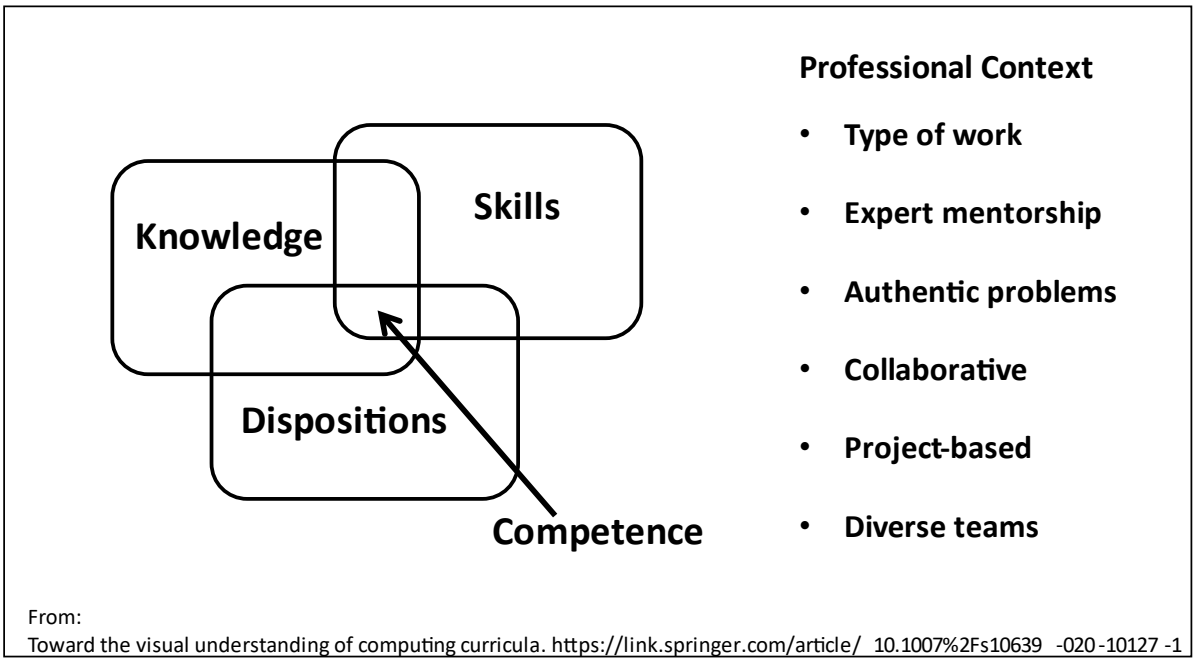


FIGURE 6: COMPETENCE COMPONENTS

Where Are the People?

First and foremost, not enough adequately IT trained people are leaving school and University to fill the IT skills gap. Other people are needed and not necessarily young.

> 'Reskilling people over 50 to work in technology could deliver an additional 119,000 IT specialists to the UK workforce and provide "a significant step" in addressing the digital skills gap, a new study has found.'

Older workers are missing from tech. That's a big problem for everyone
https://www.zdnet.com/article/older-workers-are-missing-from-tech-why-thats-a-big-problem-for-everyone/

Assuming the ideal general IT general, underpinning course exists, where are we to find the people to fill the large and growing IT skills gaps? The current demography is in essence limited to computer graduates and school leavers plus some other candidates. This is not sufficient, for two main reasons;

1. The skills imparted to graduates and senior school leavers is mainly computer science (CS) based. For reasons given earlier, this is not a good fit to the computing needs of the workplace today
2. For this reason and the relative paucity of candidates for careers in modern IT, these people boundaries need to be widened considerably.

I have compiled a list of this 'hidden horde' of people in another paper I wrote but it is reproduced here in brief to demonstrate the wide, and often surprising, talent sources available.

Into IT from Nowhere

> '**Osborne:** I don't know. I'm trying to think. How did this happen? Yeah so, I finished my degree in events management of all things and I left uni and I was like you know, I don't really know what to do. I was in that kind of weird stage where like the whole world is ahead of you, so you're like, what to do? So then I found actually Micro Focus and then I

applied through a more general sales program, and then they gave me, I think it was eight weeks of training. ‘

Maria: Actually, my story begins in preschool [*she started teaching there*]. That’s where my career started, and then I got a job in payroll and from there I got a chance to go to CGI. My previous manager at my old job recommended me to CGI because my current manager had a theory that we would like to have some person that knows the main knowledge rather than the programming knowledge, and I proved that theory to be great.’

COBOL is a relatively simple language to learn and by doing so, one doesn’t narrow ones career prospects since many recruiters maintain that every language learner should master two languages.

COBOL Is for Anyone: Transitioning to IT From Alternate Career Paths

https://techchannel.com/Enterprise/10/2022/cobol-for-anyone

Other Talent Sources

‘In addition, nearly half (47%) of data center operators report difficulty finding qualified candidates, and 38% of technology providers say staffing shortages will inhibit growth. While AI is expected to be adopted more widely in the next five years, but will not alleviate the staffing shortage. One approach is to open up recruiting to a wider diversity of potential candidates, and most vendors, 88%, expect that more diverse staff will be recruited in the next three to five years. ‘

Artificial intelligence runs more data centers, but still won't relieve technology staffing woes

https://www.zdnet.com/article/artificial-intelligence-runs-more-data-centers-but-still-wont-relieve-technology-staffing-woes/

.. but remote working with suitably trained people might.

Remote Working

Since the Covid pandemic, remote working has become widespread and is now feasible for some IT roles. See the short discussion below, followed by some types of peoppel who might fit into IT, both *in situ* and remotely.

Remote Monitoring and Management

‘Remote monitoring and management (RMM) is the practice of installing local software on devices so that IT can observe and operate them from another location when necessary. With multi-location businesses or organizations with a lot of remote workers, the IT team may be located in the central headquarters or work from home. However, they still need the ability to troubleshoot problems for other employees, and RMM software allows them to access other devices remotely, so they can identify and fix the problem. MSPs can cut down on their travel expenses and offer better rates to customers if they don’t have to travel to their client’s office to fix a problem.

With more employees working remotely than ever before, it can be difficult for IT to perform regular maintenance and updates while also providing support. Plus, more companies are turning to managed services providers (MSPs) as they struggle to find the internal IT resources they need. IT professionals can no longer just pop down to the

employee's office to see what the problem is and fix it onsite. Instead, they have to use remote monitoring and management (RMM) tools to handle support and maintenance from afar.' [from https://technologyadvice.com/]

Talent Demography

- **Ex-Services Personnel:** Three major factors lead to the idea of using ex-service personnel in the Information Technology (IT) world;

There are about 15,000 personnel leaving the armed forces in the UK each year.[3] Many are injured, unemployed, disturbed or suffering a combination of these. This pool of committed people should be targeted as soon as possible and tapped to mitigate this shortage. See the links below.

If nobody else knows that military veterans are useful IT candidates, Artificial Intelligence (AI) does.

How Employers Can Help Veterans Advance in Their Careers
https://www.itprotoday.com/career-tips/how-employers-can-help-veterans-advance-in-their-careers

ChatGPT can you list the reasons why is it good to hire a military veteran?
https://www.linkedin.com/posts/activity-7073388731461693440-orCN

https://studentveterans.org/ US

https://saluteinc.com/ + many others

https://skillstorm.com/storm/#experts Skillstorm

https://www.darkreading.com/edge-articles/veterans-explain-how-military-service-prepared-them-for-cybersecurity-careers

- **Disabled people**, a source of talent in a career which does not demand physical mobility. The topic of technology 'accessibility' is covered in US document;

https://www.informationweek.com/strategic-cio/team-building-and-staffing/good-tech-design-is-accessible-but-theres-a-skills-gap/a/d-id/1332994

'In the UK alone, 14.6 million people are disabled, including 21% of working-age adults, according to the figures from the government. Yet when it comes to disability inclusion in the workplace, there is still a long way to go, according to a Raconteur panel of experts speaking in honour of Disability Pride month.'

There are some 3 m.+ of these who are 'able' disabled, that is capable of manual and other dexterity and thus potentially IT employment capable.

Why business needs to get serious about disability inclusion
https://www.raconteur.net/hr/diversity-inclusion/disability-inclusion-workplace/

Welcome to assistive and adaptive technology

[3] https://www.gov.uk/government/statistics/uk-armed-forces-monthly-service-personnel-statistics-2017

https://www.askwoody.com/newsletter/free-edition-welcome-to-assistive-and-adaptive-technology/

How Technology Brings Blind People into the Workplace
https://hbr.org/1989/03/how-technology-brings-blind-people-into-the-workplace

Can hybrid working herald new opportunities for disabled workers?
https://www.raconteur.net/hr/can-hybrid-working-herald-new-opportunities-for-disabled-workers/

Disabled IT professionals are building access for themselves
https://www.itprotoday.com/it-operations-and-management/2022-it-operations-trends-will-it-see-role-change

'Neurodiverse conditions include ADHD, Autism, Dyspraxia, Dyslexia, Dyscalculia, Dysgraphia, and Tourette's syndrome. .... This affects up to 1 in 7 people.'

7 ways to support neurodiverse employees working from home
https://digileaders.com/7-ways-to-support-neurodiverse-employees-working-from-home/

A major them in the paper below is the abandonment of only using graduates as computing jobs candidates but in addition looking at many other possible sources of talent: disabled, refugees etc.

> 'At the more junior, 18- to 21-year-old level, meanwhile, the organisation has abandoned the standard entry devices of CVs and graduate entry. Instead, candidates' capabilities and personalities are evaluated via an online cognitive aptitude test before they progress to an internal assessment centre'.

Five fresh approaches to solving the tech skills crisis

https://www.diverseeducation.com/opinion/article/15291114/addressing-stem-underrepresentation-the-community-college-presidents-initiative

- **National retraining scheme [UK]**

  '.... to help adults retrain into better jobs and be ready for future changes to the economy, including those brought about by automation'. To this I would add those losing their jobs by business shrinkage, e.g. banks and retail in 2019. I see artificial means of reversing this trend as similar to trying to maintain the horse as transport on the arrival of the motor car.

National retraining scheme
https://www.gov.uk/government/publications/national-retraining-scheme/national-retraining-scheme

- **Females.** A CAS[4] survey carried out in 2018 showed that two of the biggest drawbacks they saw in taking computing as a subject were that it was 'boring' and 'needed to much maths'. It was also perceived as 'geekish' and the preserve of boys. This is far from the truth in modern IT and I can see females taking to it quite easily once these myths are dispelled.

CAS Females in Computing [survey 2018]
https://www.computingatschool.org.uk/news_items/705

What Is Remote Help Desk Support?

[4] Computing at School. I designed the survey but my name seems to have disappeared from its literature.

https://www.comptia.org/content/articles/what-is-remote-help-desk-support

How flexible and remote working are boosting tech careers for women
https://www.raconteur.net/sponsored/work-rewired/how-flexible-and-remote-working-are-boosting-tech-careers-for-women

- **University drop-outs** in non-IT (or even computer science) subjects

UK universities predict record student dropout rate [Sept. 2020]
https://www.theguardian.com/education/2020/sep/19/uk-universities-predict-record-student-dropout-rate

> 'Wanna know a secret? We aren't a fan of the term 'dropping out'. We prefer 'choosing to do something else'. So, whatever your reasons for leaving university to do something else – it could be the course, the cost of university, the pressures of leaving home and living up to the student stereotype – the most important thing is that you have a plan for what you're going to do next.'

University courses in the UK can cost up to £27,000 for 3 years [1Q 2023], and in the US, up to $53,000.

The link below suggests much higher UK costs may be the case:

Martin Lewis: Why the cost of going to uni will DOUBLE for many [in UK 2023]

https://www.moneysavingexpert.com/students/student-loans-2023/

Dropping Out of University
https://www.allaboutcareers.com/careers-advice/university-life/dropping-out-of-university

- **Career Changers:** 'Career changers are an untapped resource for tech employers and the tech industry offers unique opportunities for people who want to pivot their careers, despite the impact of Covid-19.'

Why are career changers the tech industry's big opportunity to bridge the skills gap?
https://www.cwjobs.co.uk/recruiters/turning-to-tech/

> 'Our research revealed that experienced tech workers are far from loyal to their current roles. In fact, almost nine in ten respondents (89%) indicated they are open to opportunities or actively job hunting. Clearly, there is an urgent need for employers and recruiters to understand what appeals to tech workers and would better engage and retain them.'

How to build a high-performing tech team

https://www.cwjobs.co.uk/recruiters/file/general/CWJobs-Powering-progression-Report.pdf

Why IT Is Still Great for Career Changers, Even Amid COVID-19
https://www.comptia.org/blog/why-it-is-still-great-for-career-changers

Are boomers the answer to the great resignation?
Employers must recruit and retain more older workers to overcome a shortage of manpower and skills that could derail economic recovery

https://www.raconteur.net/hr/older-workers-great-resignation-answer/

https://www.raconteur.net/sponsored/work-rewired/how-to-support-digital-skills-across-generations/ [link in above].

- **Early retirement people (*)** with the right mental attitude. We don't want any passengers on this trip.

'Early retirement is stoking inflation and damaging growth while adding pressure to already strained public services, according to a report into the UK's "missing" workers by the House of Lords economic affairs committee.'

Early retirement driving inflation and harming growth, says report [20 Dec 2022]

https://www.thetimes.co.uk/article/early-retirement-driving-inflation-and-harming-growth-says-report-tspgq982p

The link below tells more of this story.

https://www.linkedin.com/comm/feed/news/4615396

> 'But today's latest figures from the Office for National Statistics suggest we are experiencing yet another new labour force phenomenon. Among those aged 50-64, there was a big drop of 84,000 of "economically inactive" people, for the three months to October. That feels like the start of what might be the Great Unretirement.' [iNews.co.uk - Paul Waugh, 13 Dec. 2022]

- **Young (intelligent) people** seeking employment **(*)** but with little or no computer training. Being proficient on an iPhone or a PC might help but unlikely in face-to-face situations or lateral thinking.
- **People of suitable temperament** who are unhappy in their current, non-IT jobs

'UK findings were also damning when it came to career development. One in five young people in UK tech said they have no clear career path where they currently work, one in ten say their current company does not support their career development, and almost one in three would join a company that provided more concrete support for their career.'

Tell me, what is the career path for a person whose skill from the start is in one subject, e.g. coding in Python? Probably coding in Python from age 20 to retirement age (in UK 68), perhaps even as a senior Python coder.

Changing career (in IT) if you are *Willy* or *Wendy Oneskill* will be difficult if you don't have a basic understanding of the IT landscape, especially as that landscape is moving. Doing this is like trying to jump on the moving IT bus which is accelerating and changing direction.

More than half of all young tech workers are considering changing career
https://www.itpro.co.uk/business-strategy/flexible-working/369217/half-young-tech-workers-considering-career-change

UK tech skills gap to reduce as more Brits consider IT jobs
https://www.itpro.co.uk/business-strategy/careers-training/357653/tech-skills-gap-to-reduce-as-workers-change-careers

- **Country dwellers.** See the illuminating story below.

Cybersecurity has a desperate skills crisis. Rural America could have the answer
https://www.zdnet.com/education/professional-development/cybersecurity-has-a-desperate-skills-crisis-rural-america-could-have-the-answer/

- **Temporary work.** For people at home most of the time, there *may* well be short-term IT work they can undertake if they have some basic IT skills. Document

creation, proofreading, archiving and other tasks where basic IT knowledge and a reasonable command of English would seem attractive to hard pressed IT shops.

Having seen some output from otherwise clever IT people, I see a need for such skills, especially in marketing where design skills would be a bonus.

- **New apprenticeships**; see the links below for ideas.

Apprenticeship gets a makeover
https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/apprenticeship-gets-a-makeover

IT apprenticeships: Best practices for onboarding overlooked talent [Dec. 2019]
https://www.cio.com/article/3487396/it-apprenticeships-best-practices-for-onboarding-overlooked-talent.html

- **Minorities of Various Kinds**

The report [2021] below tells of a 22% increase in minority and marginalised people enrolments on a Community College course via online learning.

Online Learning Increases College Access for Underserved Native American Students
https://edtechmagazine.com/higher/higher/article/2021/05/online-learning-increases-college-access-underserved-native-american-students-perfcon

The report was reissued in 2022.
Online Learning Can Lead to Increased Success for Minority Students in Higher Education

https://edtechmagazine.com/higher/higher/higher/higher/article/2022/03/online-learning-can-lead-increased-success-minority-students-higher-education

- **Non-IT executives and managers**. In the era of rapid business transformation via computer methods, a link between business and IT has to be forged to make effective use of computing. This was highlighted in the Slaughter and May report on the TSB outage which occurred in 2018.

  It is also given support in the link below; 'Chief executives without technological knowledge or the ability to learn will not be able to grasp the complexities of leveraging tech for the best outcomes.'

Technophobe leaders are doomed to fail
https://www.raconteur.net/hr/future-ceo-2020/technology-vital-ceo

- **Suitable refugees**. E.g.

Jobs for Ukraine
https://jobsforukraine.net/

- **Prisoners**. People released from or even in prison and deemed trustworthy. There are numerous papers citing the use of prisoners in IT work. A brief foray into this in the UK showed it was a difficult thing to implement except perhaps via hard copy material. Released prisoners are a different proposition.

  Prison Leaver Recruitment
  https://www.civil-service-careers.gov.uk/prison-leaver-recruitment/

- **Others** as yet unrecognised as having IT potential. See the three links and extracts below.

The first link tells of people from all sorts of non-STEM backgrounds migrating to IT though it is not clear what training they had to make the jump.

Why Young Talent Is Adopting Tech as a New Career Option
https://www.datacenterknowledge.com/data-center-jobs/why-young-talent-adopting-tech-new-career-option

> "You have to be willing to hire someone who knows nothing," advises Jim Johnson, senior vice president at recruitment firm Robert Half. "Everything we use as a skill can be learned and can be taught."

Although it may be a stretch, it could be worthwhile to take a second look at a musician or a teacher, for instance, who wants to make a career change, especially if their previous jobs included a strong tech component. "Look for personality and a track record of success," Johnson says, or what he calls aptitude and attitude. Ask the candidate to explain how they best learn new things, he suggests, or how they've done so in the past.

CIOs rethink how they hire for hard-to-fill IT roles
https://www.cio.com/article/410891/cios-rethink-how-they-hire-for-hard-to-fill-it-roles.html

> 'Non-traditional talent pools are also an important area to include in the search for new blood. Military veterans, local universities and STEM (science, technology, engineering and math) programs are gaining in popularity as ways to strengthen the talent pipeline.'

Data Centers Scrambling to Fill IT Skills Gap
https://www.datacenterknowledge.com/archives/2017/02/07/data-centers-scrambling-fill-skills-gap

> 'So, in this spotlight we focus on the broader and longer-term issue of the world of work for those with a disability. This is important because there has been a large increase in the number of working-age disabled people (up 2.3 million), with most of that driven by those in employment (1.9 million). Over half the increase in the number of disabled people in employment has been driven by more people with a disability, as opposed to an increase in the disability employment rate. The result, as shown in Figure 1, is that the share of the working-age employed population with a disability has grown from around 10 to 15 per cent between 2013 and 2022.'

Labour Market Outlook Q3 2022
https://www.resolutionfoundation.org/publications/labour-market-outlook-q3-2022/

Speaking of the UK alone, there are millions of candidates in the categories above which are possibly suitable for IT training. In the UK, there are over 13 m. people registered as disabled with c. 3 m deemed 'fit for work' but not necessarily for travel. This is where the trend to working from remotely (home), already developing, has come to the fore in the Covid 19 pandemic.

There are several articles supporting the idea that to even dent the IT skill shortages, it is necessary to look beyond academic degrees and school certificates for the numbers of people needed here. The numbers also dictate online training as the learning medium, plus the fact that currently there are few teachers who speak 'modern IT'.

The link below supports to the hilt what I and others have just said.
Somebody agrees with me about talent sources;

'Step - Identify Overlooked Talent Pools

- Older workers.
- Formerly incarcerated individuals.
- Individuals with disabilities.
- Global talent.
- Veterans. ‘

How to Address the Skills Gap

https://www.shrm.org/resourcesandtools/tools-and-samples/how-to-guides/pages/how-to-address-the-skills-gap.aspx

Your next security hire might not come from tech
https://www.computing.co.uk/interview/4040311/security-hire-tech

For ‘*new kids on the IT block’*, university education is not the correct vehicle. I am sure that a well organised training/apprenticeship combination is the ideal method of bringing them into IT.

> ***Summary*****:** The people are there, the means of mobilising them into an elite IT fighting force is not. You do not join the SAS or Seals straight off the street, with or without a $/£ 125 serviceperson certification. Remember this.

Is eLearning Enough Though?

> ‘eLearning can be just as effective as instructor lead training if it is done well although some people may argue with this statement. Researchers like Derouin (2005) and Paul (2014) and others have already confirmed this years ago with academic research.’

How long do learners expect eLearning to be?
https://www.ibm.com/blogs/ibm-training/how-long-do-learners-expect-elearning-to-be/

See the **Summary** at the end of Appendix 2 below.

One Thing is Certain on the Skills Front

The IT skills shortage will not be solved solely by teaching school and university students (or anyone else) computer science, neither will face to face teaching. The numbers of suitably – that is, workplace IT - qualified people needed to fill the ever-growing skills gap is too great.

> I feel the major part of the solution is to develop online learning (eLearning) until such a time there are sufficient modern IT qualified teachers available. Even then, it may be a more expensive route than the eLearning coupled with a suitable apprenticeship.

The maturity of online learning had advanced since the Covid lockdown era and will continue to evolve to nearly match 'classroom' teaching via an instructor.

APPENDIX 2

McKinsey on Skills and Learning

1. 'Formal learning opportunities account for only a small percentage of the learning a professional needs over the course of a career. Everyday experiences and interactions offer tremendous learning opportunities, but only if you intentionally treat every moment as a learning opportunity. While intentional learners embrace their need to learn, for them learning is not a separate stream of work or an extra effort.'

People . . .

. . . spend too much time on the same skill. When you're good at something, it generally feels good to keep doing it. Seeing improvements may tempt you to keep practicing the same skill. But once you've started to improve, practicing the same things doesn't propel you forward. In fact, it may actually undermine your efforts to build expertise, making you overly reliant on gut instinct.

. . . narrow in on specific areas and items in which you are not yet skilled. As your skills evolve, focus on those things that require you to stretch.

.. instead you should . . .

The most fundamental skill: Intentional learning and the career advantage
https://www.mckinsey.com/featured-insights/future-of-work/the-most-fundamental-skill-intentional-learning-and-the-career-advantage

'Half of those who expect skill gaps in the years ahead say skill building will be the most effective action for their organizations to take, whereas 31 percent cite hiring as most effective.' .....

'Build training capabilities and partnerships. Applying the science of learning will improve the outcomes of any reskilling effort. Companies should structure the learning journey to help employees retain new skills and apply them to their role. To do so, the reskilling curriculum should blend in-person and digital learning opportunities. Employees should be assigned to train in a cohort of employees with similar experiences and should be involved with projects that allow them to practice skills while they learn. Because organizations may need to cultivate a broad range of workforce skills, they will likely need to assemble learning resources from multiple providers—for example, online platforms, universities, and technical organizations. Fostering a culture of lifelong learning also can encourage employees to develop new skills.' .....

'As more tasks become automated and companies redesign jobs to encompass different activities, it will be critical to enact strategies that help employees develop the new capabilities needed. This will be a major undertaking. Our survey results suggest that most companies will prioritize learning and development as they try to close skill gaps'.'

https://www.mckinsey.com/business-functions/organization/our-insights/beyond-hiring-how-companies-are-reskilling-to-address-talent-gaps

2. Lifelong Learning and More

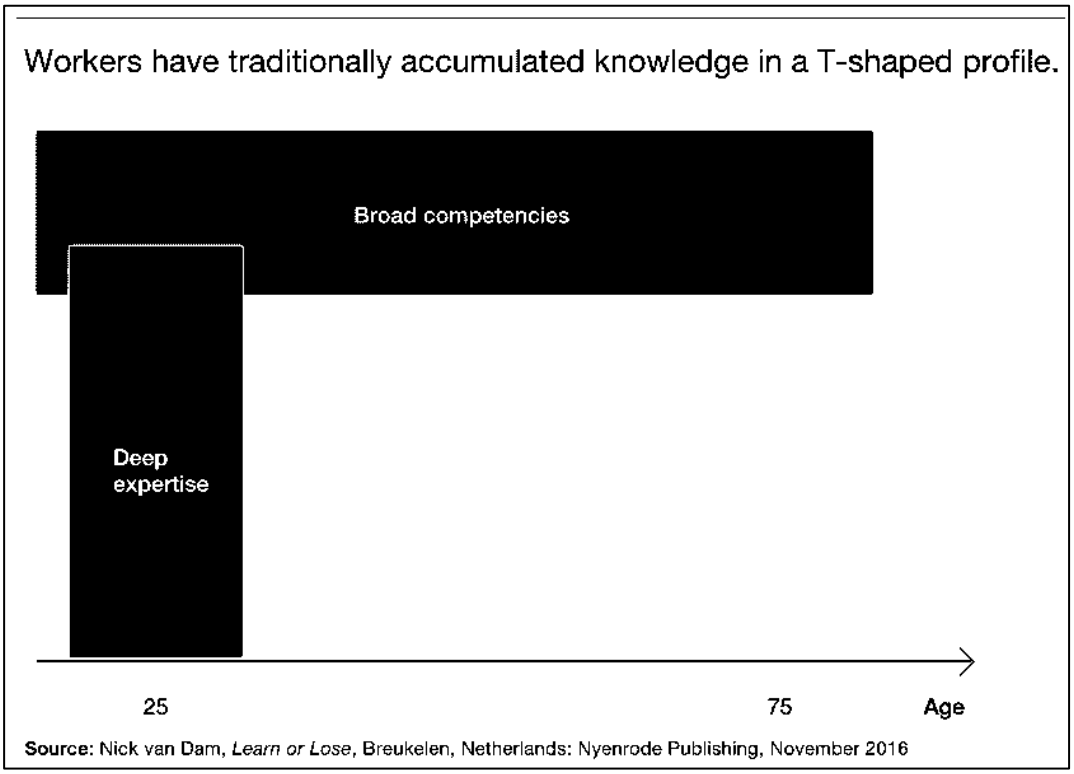


FIGURE 7: TRADITIONAL LEARNING PATTERN

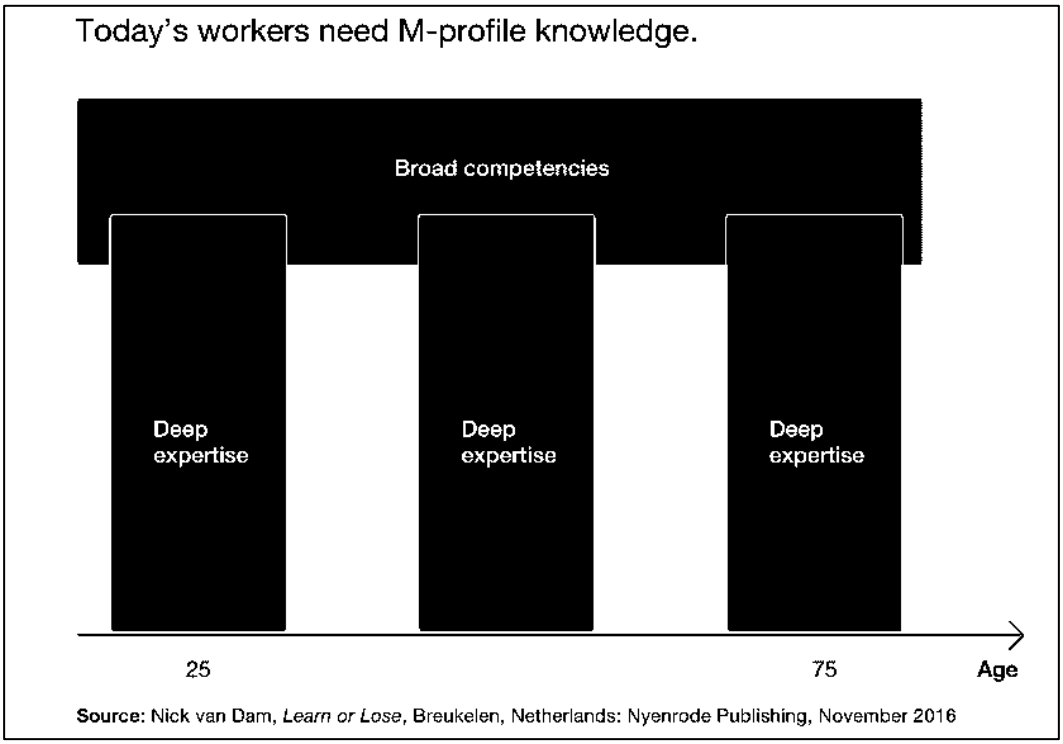


FIGURE 8: RESKILLING LEARNING TYPES

These two figures encapsulate my (becoming tiresome) thesis about a broad underpinning (‘*broad competencies’*) in current workplace IT which confers the ability to mutate to other specialist areas. This is illustrated in Figure 6.

Seven essential elements of a lifelong-learning mind-set
https://www.mckinsey.com/business-functions/organization/our-insights/seven-essential-elements-of-a-lifelong-learning-mind-set

Summary

This paper seeks to address the issue of the shortage of relevant IT skills to satisfy the workplace, the reasons and the outline of a solution.

- Current IT education has not made any impression on the IT skills shortage, which is growing in volume and complexity
- Current education is fragmented such that to attain a broad IT education would require studying extracts from scores of courses with much supplementary reading, an impossible task
- Much of this education is static or near-so which does not augur well for keeping up with IT evolution
- The IT ‘student’ demography is relatively narrow, focussing mainly on youth, computer science and internet ‘geeks’. Many other types of ‘student’ was outline above.

The McKinsey reports above this summary contain a mass of information from surveys, basically about business in changing times, that change accelerated by the Covid crisis. In most cases, change means business change and that means reskilling to meet that change.

In most companies, business is tightly knit with IT (indeed dependent on it) and business change means IT change, which in turn means skills change or at least a skills mutation. Whichever way you slice it, the skills you had when you joined ACME Corp. will need to be complemented or even buried under new ones which cater for business change, aka *digital transformation*.

> The best way to reskill in IT is to have a solid IT underpinning knowledge when you join ACME Corp. and your reskilling will be much easier (see Figure 6. above).

I am not copying McKinsey since what I am saying here, I have been preaching for years – since 2017 - under the banner ‘*No specialisation before generalisation’*. There is a real issue in developing an IT skill in depth and hoping it will carry you through life. I can assure you it will not (see the dozens of supporting quotations and links at the end of the previous section).

IT changed markedly during my career in an era which changed at about a third the rate it changes today; even so, I had several jobs across several industries although the latter may not happen to ACME man or woman.

However, should ACME person move on (or be ‘released’), the basic skills will be a huge bonus, especially if maintained along the principle of lifelong learning.

Willy Oneskill

In short, the one-skill person might, in technical terms, be *up the creek without a paddle* in the volatile, competitive workplace where IT hugs the changing business, jobs mutate and where it takes these *two to tango* - or we both fall down. This is what is known as a bad thing for business'.

Here Endeth the Lesson

Go forth and spread the general IT training 'gospel'.

Conclusion

What these 'pundits' in the last section are saying is '*keep your options open to survive the roller-coaster of modern IT*' and '*Keep learning'*. It is much easier to develop a broader view of IT early rather than when your 'silo' job looks shaky, or an emergency role-fill situation arises, isn't it? See the *Hoffer* and the *man from Harvard's* quotations at the beginning and end of the section above, respectively.

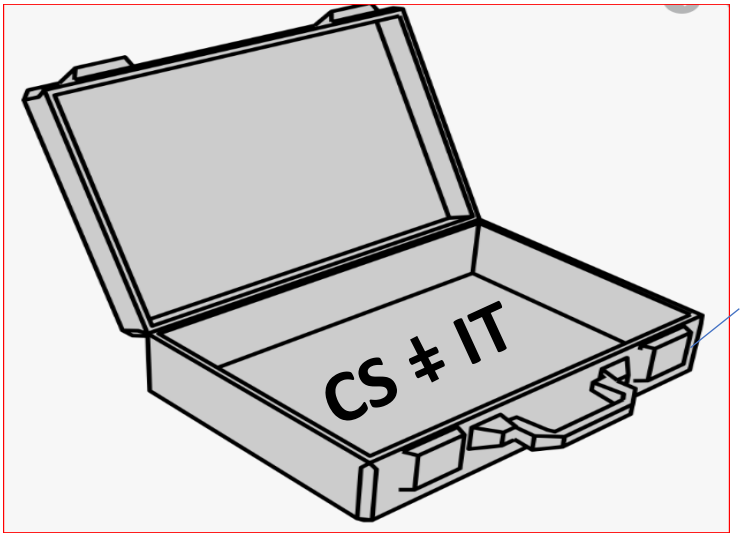


FIGURE 9: COMPUTER SCIENCE (CS) IS NOT THE SAME ASWORKPLACE INFORMATION TECHNOLOGY (IT)

MEMBERS OF THE JURY, I REST MY CASE HERE.

APPENDIX 3

IT Topics List

The list of topics presented in this appendix is representative of the modern IT environment. Its content has been agreed as representative, with a few plusses and minuses, by three of my peers.

Numeric & A

2FA
2PC
3D Printing
5G
abstraction (IT version)
access control
actor
agile software development
amplification attack (DNS)
analytics
analytics, predictive
Angular
anomaly detection
anonymization
ANSI
Apache
API
applets
application security
application security tools
APM
APT
array (or vector) processor
artificial intelligence (AI)
AI, hardware
AI, Trusted
As a Service
asymmetric multiprocessing
ATT&CK (MITRE)
attack surface
attack vectors
audit, IT
authentication
authentication, adaptive
authentication, biometric
authentication, risk based (RBA)
authorisation

automated software development/testing
automated security
automation, I0T
automation, IT
autonomic computing
availability

B

backups
balanced scorecard
balking
behavioural analytics
bandwidth
baseline
Bayesian Statistics
BEC
benchmark
big data
big data analysis/analytics
Big Six
bi-modal IT
bitcoin
blockchain
bot
BGP
bottleneck
botnets
boundary firewall
browser
business continuity management (BCM)
business continuity planning (BCP)
business impact analysis (BIA)
business process management (BPM)
BYOD

C

cache
cache coherence
cache hit
CAD
CAE
CASB
CDMI
CEO fraud
change management
checkpointing

CICS
client-server model
cloud
cloud functions
cloud, hybrid
cloud, management
cloud, private
cloud security
cloud, service providers
cloudlet
cluster
cloud, virtual
cluster, HPC
code injection
code signing
cognitive computing
colocation
compliance, IT
Composable Infrastructure
connectivity
component failure impact analysis (CFIA)
compression
computer performance
congestion control
consolidation (IT)
containers
container, data centre
content management
content management (web)
continuous delivery
continuous testing
converged infrastructure (CI)
cooling (computer)
CopyCat malware
cpu
cpu bound
CRM
cryptocurrency
cryptocurrency mining - legal
crypto currency mining - malware
Cryptor
CVE
cvss (Security)
cyber definitions

cybersecurity
Cyclic Redundancy Check

D

data centre management
database
dataops
data protection
data replication
data repositories
data science
data security
data warehouse
DCIPS
decoupled architecture
deception technology
decryption
deep learning
deduplication (of data)
deep packet inspection (DPI)
Delphi technique
development cycle
devil's advocate
DevOps
DevSecOps
DevOps Software Security
dictionary attack
digital forensics
digital transformation
disaster recovery (DR)
DLP
DMARC
DMZ (Demilitarised zone)
DNS
Docker
document management
Dropbox
DRAM
DRDA
Drupal

E

ECC (error correction code)
edge computing
edi
EDR

E(A)EC (extended or advanced error correction)
email malware
encryption
encryption algorithms
encryption, data types
encryption, homomorphic
endpoint
endpoint management
endpoint security
ENISA
enterprise architecture
erasure codes
ERP
error detection and correction

F

failure
fault tolerance
FCAPS
FDDI
fintech
firewall
firmware
first mile
FISMA
flash storage
flops
Flynns taxonomy
fog computing
forensics
forward error correction (FEC)
fragmentation
fragmentation, mass data
frameworks
full stack development

G

gateway
GDPR
GKS
GL (OpenGL)
GNU
GPU
graphics
GUI (graphical user interface)

H

hadoop
hadoop cluster
hardware scalability
hardware security
HDD (Hard Disk Drive)
heuristics
high availability (HA)
hop
HPC
HTML injection
hybrid cloud
hyperscale computing
Hypertext Markup Language (HTML)
Hypertext Transfer Protocol (HTTP)
Hypertext Transfer Protocol Secure (HTTPS)
hyper-convergence (hyperconvergence)
hypervisor
hypervisor functionality
hypervisor security
hypervisor, Xen or Zen

I

identity access management (IAM)
IAST
ICANN
Identity and access management (IAM)
IEC
IEEE
IETF
in-memory computing
information security
instruction cycle
intent based networking (IBN)
internet
internet, decentralised
internet of things (IoT)
internet protocols
internet streaming
interoperability
intranet
intranet security
IDS

intrusion signature
IoT architecture
IoT dashboard
IoT Standards
IPv6
IPC (InterProcess Communication)
IPS
(ISC)²
iSCSI
ISO27001
ISO 20022
ISO22301
ISO general
IT governance
ITIL
ITL
ITOA
ITSEC
ITSM

J

jargon
Java
Java Beans
Java Classes
jdbc
JSON
jitter

K

Kendall notation
kilo
KPI
Kubernetes

L

languages
last mile
latency
Legacy system
link aggregation (network)
Linux
LinuxONE
load average
load balancing

logging
lossless (compression)
low-code
LRC (longitudinal redundancy check)
LTO
Lussers law

M

machine learning (ML)
malware
malware detection
malware macros
managed services
management (systems)
MariaDB
measurements of data
mean
median
memcached
message queuing (MQ)
meshes
metadata
micro data centre
microcode
microservices
migration
MIPs
MMU
mobile security
MongoDB
Monitor, monitoring
monitoring, synthetic
Moores Law
multicloud
multi-factor authentication (MFA)
multiplexing

N

NAS (Network Attached Storage)
natural language processing
NCC0E
net neutrality
network availability
network emulation
network intelligence
network management

network mapping
network monitoring
network operations
network packet brokers
network performance
network protocol
network security
network simulation
network segmentation
network topology
neuromorphic chip
NFV (Network Function Virtualisation)
NIDS
NIPS
NIST
non-repudiation
NPMD
NVM (Non-Volatile Memory)
NVMe

O

object oriented programming (OOP)
object storage
OCSP
odbc
OLAP
OLTP
OOP
open compute project
open networks
open source
OpenStack
operating system (OS)
operating system, trusted
operations manual
Orange Book
orchestration
open source initiative (OSI)
OSI
OPSWAT
OWASP

P

packet
packet filtering

packet switching
packet sniffer (analyser)
paravirtualization
parity
PCI(e)
penetration testing (pentest)
percentile
perimeter, network
perimeter, software defined
persistent memory
persistent storage
ping
phase change memory
PHIGS
physical security
playbook(s)
pods [container]
portal
POSIX
PowerShell
PPM (project and portfolio management)
privileged access management (PAM)
process injection
programming languages
Project Definition Workshop (PDW)
Protocols
Protocol emulation
proxy server

Q

Quality of Service (Q0S)
quantum computing
quantum cryptography
quantum key distribution
quantum entanglement
queuing
queuing theory

R

RAID
RAIM (Redundant Array of Independent Memory)
RAS
RASP
rationalization (IT)
refactoring

reliability
resilience
resource
response time
REST(ful)
RFC
RISC
RISC-V
risk management
ROBO
robotics
ROI
root cause analysis
Root Cause
RPA
RTOS
rules engine
runbook

S

saltstack
SAM (software asset management)
SAN (Storage Area Network)
sandboxing
scalability laws
scale out
scale up
SCAP
scrum
SDN
SDP
security, general
security, mobile
security models
security operations centre
security, regulatory compliance
security, software
security, terminology
serverless computing
service (IT)
self-encrypting drives (SED)
Standardization
Simplified
Service Level Agreement (SLA)
service management

service meshes
shadow IT
sharding
SIEM
six sigma
SLA
SLA (Cloud)
smart devices
SNIA
SOA (Service Oriented Architecture)
SOAP
SOAR (AI)
SOAR (Security)
software composable infrastructure
Software Composition Analysis
software defined data centre (SDDC)
software defined network (SDN)
software defined storage (SDS)
software defined WAN (SD-WAN)
software security
software testing
software testing automation
site reliability engineering (SRE)
SSD
SSL
stateful/stateless
Storage Management Initiative (SMI)
storage tiering
supercomputer
superscalar
systems management

T

TCO
TCP/IP
TCSEC
TensorFlow
thick client
thin client
tiering (resource)
time
tlb
TLS
TOGAF
Traffic

trusted operating system
trustworthiness

U

UEM (User Endpoint Management)
UI/UX
Unified Communications
Unified Storage
UNIX
unstructured data
UPS
UPS, Flywheel
uptime
Uptime Institute
usability, software
UTM (Unified Threat Management)

V

VDI
VDP
viewpoints (documents)
viewpoints (systems)
viewpoints ()
virtualisation
virtual disk
virtual LAN (vLAN)
virtual machine (VM)
virtual memory
virtual reality (VR)
virtual replication
virtual SAN (vSAN)
virtual server
virtualisation sprawl
virtual tape
vLAN
VLN
VPN (virtual private network)
VR
VSN
vulnerability assessment
vulnerability management
W
W3C
waiting for I/O
WAN acceleration

WAN optimization
war room
waterfall model
waterfall diagram
web filtering
web page
web pages (dynamic)
web pages (segmented)
web pages (static)
white box testing
Wi fi
Wi-Fi 4
Wi-Fi 5
Wi-Fi 6
wire data

X

Xaas
X client
XR (Extended Reality)
X server
X terminal
X window system
Xen

Y

Y2K
Yottabyte (YB)
YouTube
Ymodem

Z

Zen hypervisor
zero knowledge proof
zero-knowledge protocol
zero trust model
zombie VM
End of List