

**Response from the UK Computing Research Committee (UKCRC) to the Lords Digital Skills Committee regarding the inquiry “to consider information and communications technology, competitiveness and skills in the United Kingdom” and to report by 5 March 2015.**

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The UK Computing Research Committee (UKCRC), an Expert Panel of the British Computer Society, the Institution of Engineering and Technology and the Council of Professors and Heads of Computing, was formed in November 2000 as a policy committee for computing research in the UK. Its members are leading computing researchers who each have an established international reputation in computing. Our response thus covers UK research in computing, which is internationally strong and vigorous, and a major national asset. This response has been prepared after a widespread consultation amongst the membership of UKCRC.

UKCRC believe that digital skills can be described through a small set of levels or groups:

1) The “basic digital skills” that are required by the general public to use electronic services include web browsing, email, electronic banking and payment, online appointment booking, form filling etc., and also include the management of digital identity, privacy and security, social media, GPS and location services, and telecommunications including e.g., Skype and WiFi. These are a varied set of basic skills that are needed by the “consumers” of digital technology and which are constantly evolving over time. The acquisition and update of these skills constitutes a major societal challenge that contributes to the digital divide.

2) Another level of skill with regard to Information Technology (IT), which does not necessarily include all of the skills listed in the previous set of basic skills, relates to those people who use information technology in the workplace. They will need the skills to use word processors, spreadsheets, databases, and all kinds of transactional systems in support of office work, business processes etc. Many web design activities that use existing software packages also come under this heading, though this activity in general may fall both in this level, and in the one we describe in 3) below. Skills that are needed to operate digital systems in manufacturing, transport, and healthcare using domain specific digital interfaces that can require some level of programming are also included in this level. One might term these people as being the “Operators” of digital technology. Some of these Operators may actually be skilled professionals in their own fields, as with regard to complex and critical medical equipment. Such individuals would “programme” their medical devices or systems, but would not generally know how to take these skills into the core IT areas such as computer programming in general. Thus professional computer programming together with the use of advanced programming and software engineering tools do not come under the headings 1) and 2).

3) At a distinctly more advanced level in their knowledge of IT, are the specialists who know how to install, operate, manage digital technology infrastructure (e.g., networks, server farms, enterprise desktop administration, web services, etc.), and update it when new systems or versions are released. These are the “engineers” who keep the digital infrastructure running, and include experts

who have graduate and post-graduate degrees in Computing, Computer Science and Electrical and Electronic Engineering. Obviously, these individuals will have undergone formal training in computer programming, even though many of them may not do a substantial amount of programming in the course of their work.

4) The Applications builders are the domain-skilled programmers who produce software, and may not have all of the skills of the IT specialists of category 3). For instance they may not have the deeper knowledge in operating systems and telecommunications that are required by the IT engineers, but they will have programming skills, and should have software engineering skills. These are the specialists who can build new Applications in support of their business or for business sectors such as banking or retail. This category is critical as more and more business sectors rely on electronic systems and processes. Indeed, every industry/sector needs creative, skilled IT professionals who can keep their business competitive by exploiting IT to the best advantage. Their skills may extend from basic plugging together of packages provided by others through to new technology and application development. Many of these specialists will have graduate or post-graduate degrees in Computer Science or Computing, and some of them may be self-employed as founders of technology start-up companies.

5) Finally we must mention the Technology developers. They will typically work for companies developing new digital technologies, devices and hardware, applications, software tools, etc., or they may be self-employed or involved in start-ups. They are the core “suppliers” of raw digital technology on which all the other activities depend. Such developers will have different levels of qualifications in Computing, Computer Science, Electrical and Electronic Engineering, Mathematics, Physics and other fields, all the way to PhDs and post-doctoral training.

Many of the activities that we have outlined, in particular those at Levels 3), 4) and 5), require that the result of the IT professional’s work must meet certain industry standards, such as ISO 25010 for software quality, including correctness, MIL-STD-498 or ISO 62366 for dependability, ISO 9241 for usability, other standards for security, performance, reliability and dependability, proper documentation, and so on. Thus each of the skill levels will require some form of testing and certification.

In turn, the products that people having such skill levels produce, whether they be hardware or software, or complex devices that include multiple software and hardware components, will require testing and certification, so that there is a tight relationship between IT skills and their certification on the one hand, and IT products and their quality standards on the other.

One significant characteristic of all the levels and areas we have mentioned is the substantial renewal they undergo with respect to their technical content in phases that may last a few years to a decade. Thus, Digital Skills in particular, require that even a well-educated population and workforce will need to access cost-effective opportunities for life-long learning, retraining and knowledge and skill enhancement. Digital Skills are directly derived from prior and continuously ongoing Research and Development efforts that take place around the world and in the UK. A successful,

internationally competitive, well-funded, and vibrant UK Research capability in Computer Science, Computing and Electrical and Electronic Engineering is the best guarantee that Digital Skills in the UK will attain and surpass the highest world class capability that can best serve the country's economy and its strategic interests, since it will allow the timely identification and transfer towards industry and commerce of skill levels as they evolve, and provide the expertise to educate both the professionals and the new generations of experts that are required by the nation.