Digital Skills for Employment

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Abstract. How are digital skills developed for those involved in life transitions to employment? Digital skills are developed over time. Some of these skills are developed in formal education, others in informal and non-formal education settings. Digital skills are acquired over time through educational and social use of technology, through formal instruction, informal self-learning and learning from peers. Our world today requires digital skills to enable an individual to succeed in finding, evaluating and creating information for further and higher education, training and employment. This paper examines the need for these skills, some European initiatives and the frameworks which define the skills.

Keywords: IT competency, frameworks, IFIP, CEN, basic ICT skills

1 Introduction

Technology is changing the way people live in today's "Information Society". Work is global, personal communication is immediate and information is available at all times of the day and night. Digital skills are needed to understand and cope with these changes as a person moves through the various stages of life. As the European Union (EU) has stated, "Information and communication technologies profoundly and irreversibly affect the ways of working, accessing knowledge, socialising, communicating, collaborating - and succeeding – in all areas of the professional, social, and personal life of European young people and citizens" [1]. The Digital Agenda for Europe [2] recognises the need for digital skills for innovation and growth in Europe and notes that the skill requirements are constantly changing: "In a competitive and rapidly changing world, workforces need to be capable of continuously adapting to shifting job requirements and organisation procedures related to new skill-intensive technologies" [3].

Unemployment in the EU reached 10.7% by December 2013, yet the number of "digital jobs" is growing at a rate of 3% per annum [4]. A recent IT Skills Audit [5] estimated an excess of over 4,500 unfilled jobs in the ICT sector in Ireland and a 2014 report from LERO, the Irish Software Engineering Research Centre, predicted that thousands of Irish software jobs could be lost as a result of the growing IT skills shortage. As technology touches all levels of society and business, e-leaders with digital skills (e-skills) are needed at every level in an organisation [6]. According to Accenture [7], "Every Business Is a Digital Business"; it could be argued that every employee needs digital skills. In 2011, EU commissioner Neelie Kroes said, "You

are nowhere without digital skills in the 21st century"[2]. But what are these skills? There have been several frameworks developed to address this issue and to help employees identify skills gaps in supporting a life transition. This paper examines the different definitions of the skills, and the skills' frameworks that have been developed to help understand what is needed during major changes in a person's life.

2 The Need for Skills

2.1 The world of work is changing

The concept of a 'job for life' has disappeared. Both employment and organisations are becoming increasingly precarious; many jobs have become contractual, part-time or flexible and the average lifespan of a company has fallen since 1960 from 76 years to 15 years [8]. The acquisition of digital skills can give people entering, or re-entering the workplace greater choice and job security. More importantly, the decreasing cost of technologies and learning how to use them opens up new opportunities for self-employment and entrepreneurship that had previously been denied (e.g. Arduino, Raspberry Pi, 3D printers).

A person needs to demonstrate a large variety of "complex cognitive, motor, sociological, and emotional skills" [9, 10] to take benefit from technology and the Information Society. Without these skills there is a danger of being excluded. It is important that people know how to use technology safely and securely. Using the Internet often involves entering personal details on a web page and putting pictures on a social networking site that can expose a person's privacy and can involve the person being "tagged", thus allowing the searching for all pictures which may be held in any system worldwide. This "tagging" is growing and likely to grow further – "Recently, with the popularity of social networking websites, we observe a massive number of user-tagged images, referred to as "*social images"*, that are available on the web" [11]. There are implications for the future, for employment prospects, future careers and personal privacy. Global positioning systems (GPS) and geographic information systems (GIS) are very useful in finding routes to unfamiliar places, but these location-based technologies can also identify where the user is at any moment as he or she moves around.

"Cloud computing" is a term used often but most people do not know that they are actually using cloud computing. With cloud computing some or all of the software and hardware services can reside on the Internet and the person using the computer need not know where. According to Hayes [12], "As software migrates from local [personal computers] PCs to distant Internet servers, users and developers alike go along for the ride." Cloud services can be accessed by any user (client) interface, for example telephone, tablet, any mobile device, monitor, computer or any intelligent device. Large organisations are using the cloud to reduce costs by using information technology (IT) resources only when they need them as an "on demand" service. This service has been likened to the switching on of electricity [13]. There are security

[2] http://europa.eu/rapid/press-release_SPEECH-11-836_en.htm

issues in using the cloud. Companies must consider the reliability, the service levels and the security of data and systems in the cloud; individuals must be aware of the security and privacy of their data. It is vital that people are aware of privacy issues when they are using technology in their daily and business lives, in what Moran *et al.* [14] refer to as "the personal information cloud, i.e., the working set of information that is relevant to the individual and his work".

2.2 Teachers

Teachers need to understand technology and its use in education. Teachers must have a basic knowledge of technology and must be able to use e-learning tools to create course content, to set assessments, to enable collaborative work and to design the administrative functionality required for their specific class. This usually involves the use of a learning management system and a content management system. Students need to know how to access the classes, register online, communicate with teachers and other students and download material as required. They all need to know when technical help is needed. Awouters *et al.* [15] believe "Teaching and learning with [information and communication technologies] ICT requires specific competencies for teachers and lecturers" and "using a Virtual Learning Environment like Blackboard or Moodle demands more didactical than technical skills. Especially e-learning and blended learning is too demanding to let teachers learn to use these tools only by experimenting." John and Wheeler [16] discussing the needs of learners in the classroom identify the change that technology brings - "There is a need, for example, for students to engage with digital media in a number of ways, transcending those which are required to learn from paper-based text or images".

Bawden [17] expresses concern that teachers have not taken up the challenges of technology and asserts that "Information literacy and digital literacy are central topics for the information sciences. They are associated with issues as varied as information overload, lifelong learning, knowledge management and the growth of the Information Society. Naturally, they have been much discussed in the literature, but not, perhaps, as much as their importance deserves; in particular, they have not impinged much on the practitioner." While there have been positive developments since 2001, in particular the rise of Massive Open Online Courses (MOOCs) such as Coursera and the Khan Academy, these issues have not yet been resolved.

The management in educational establishments must also understand the needs - "Teachers who want to change need an innovative environment to act in. Therefore also management has to change." Another consideration might be the measurement of the e-skills achieved so that the effectiveness of the teaching can be measured and gaps in the process can be discovered; this is included as a priority in the Digital Agenda [18].

2.3 Information literacy

Information literacy enables the individual to be discriminating in the information available to him or her. So much data is available online and it is necessary to be able

to evaluate the accuracy and integrity of such data - "IT literacy... must also capture the notion of information literacy – the ability to assess the validity of various sources of information" [19]. The European Union agrees: "In the global information and knowledge society, the ability to communicate competently in all old and new media, as well as to access, analyze and evaluate the power of images, words and sounds, is a fundamental skill and competence for every young European citizen. These skills of media literacy are essential for our future as individuals and as members of a democratic society" [20].

2.4 Lifelong learning

Technology can facilitate learning at any time, any place and throughout one's life. Lifelong learning is becoming accepted as a necessity in personal and working lives. Included in the European Union's "Key Competences for Lifelong Learning" are the needs for competencies in "learning to learn" and "digital competence" where it is stated "Competence in the fundamental basic skills of language, literacy, numeracy and in information and communication technologies (ICT) is an essential foundation for learning". As technology is used more in education and in everyday lives, there is a need to continue to develop skills in this area. Lifelong learning can be facilitated and made more accessible with technology. Information literacy, as part of digital literacy, is necessary for participation in learning.

The European Union recognises the need for lifelong learning and talks of the "triangle of lifelong learning", this triangle being education, research and innovation. The European Centre for the Development of Vocational Training [21] stresses the importance for society - "Lifelong learning supports creativity and innovation and enables full economic and social participation." This is not a new idea; Kilpatrick said in 1918, "We of America have for years increasingly desired that education be considered as life itself and not as a mere preparation for later living. The conception before us promises a definite step toward the attainment of this end. If the purposeful act be in reality the typical unit of the worthy life, then it follows that to base education on purposeful acts is exactly to identify the process of education with worthy living itself" [22].

2.5 Technology acceptance

Companies must overcome the potential barriers to the use of technology. People will use technology if they think it will help them and people will use technology if they find it easy to use. Davis [23], investigating why people accept technology, defined "perceived usefulness" as "the degree to which a person believes that using a particular system would enhance his or her job performance" and "perceived ease of use" as "the degree to which a person believes that using a particular system would be free from effort". This "Technology Acceptance Model" (TAM) was developed in 1989. Today, people have little choice but to accept technology, therefore digital literacy is vital to understand how technology can help and how to use it. In business, digital literacy is vital to ensure the success of new systems. The King and He [24]

research asserts that the TAM is a reliable predictor for the successful implementation of computer systems in business. Applying the findings to digital literacy, it could be argued that digital literacy knowledge and skills address many of the issues identified and that the TAM can be applied to the use of technology in personal lives. If a person is comfortable and confident in using technology, he or she will use it. If not, the technology will be avoided or could be used incorrectly. This has implications for business in the future.

When introduced to new technology, people adopt the technology at different speeds, from those who are enthusiastic about technology and keen to adopt it to those who are slow to take it up. The Diffusion of Innovations model [25] was first used to describe farmers' attitudes in the United States towards the adoption of science and technology. However, it has been used since 1962 to describe the adoption of modern technology in business. In his research, Rogers identifies five different levels of adoption. "Innovators" are the first people to adopt an innovation; they will take risks and may fail. Usually these people are young, wealthy and are close to other innovators. "Early Adopters" are "more discrete in adoption choices than innovators" and will follow the innovators in adopting a technology. "Early Majority" people adopt an innovation some time after the innovators and early adopters. "Late Majority" people will adopt an innovation after the majority of society and "Laggards" are the last to adopt an innovation. This model is normally applied to the take-up of new or "leading edge" technology by business. Nevertheless, the model could be applied to the adoption and acceptance of technology by the ordinary citizen. Having digital literacy can increase the adoption rate and the quality of decision making, making individuals more critical of new technology and its mode of application, and understanding when it is time to be innovative and when it is time to disengage from an intrusive or exploitative innovation.

An issue which must always be considered when adopting technology is the dependence on this technology and the risk that basic skills of living could be lost. It is important to understand the "prudent" use of technology; as Prensky [26] says "Digital wisdom is a twofold concept, referring both to wisdom arising *from* the use of digital technology to access cognitive power beyond our innate capacity and to wisdom *in* the prudent use of technology to enhance our capabilities."

2.6 e-Leadership

The European Union describes e-Leadership as "the capabilities needed to exploit opportunities provided by ICT, notably the Internet; to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organisational processes; and/or to establish new businesses."[3] It could be argued that the skills required to be an e-leader can be found not only in an Information Society environment but also in all ***areas*** of business and all ***levels*** within an organisation.

[3] http://ec.europa.eu/enterprise/sectors/ict/files/eskills/insead_eleadership_en.pdf, p10

3 Digital Agenda

EU policy suggests that the Information Society can improve the lives of citizens, improve productivity, promote innovation and create a better society [27]. There have been several initiatives designed to promote the use of technology to improve lives, opportunities for citizens and Europe's position as a technology leader. The eEurope "An Information Society for all" initiative endorsed in 2002, aimed to bring every citizen into the digital age, create a digitally literate Europe and ensure that the process was inclusive by 2005 [28].

The Action Plan to deliver eEurope 2005 was launched at the Seville European Council in June 2002 and was endorsed by the Council of Ministers in the eEurope Resolution of January 2003. It addressed public services, e-business and of broadband access. It concluded in 2005 and was followed by i2010 (European Information Society in 2010) with the objective of ensuring "that Europe's citizens, businesses and governments make the best use of ICTs in order to improve industrial competitiveness, support growth and the creation of jobs and to help address key societal challenges" [29]. According to the i2010 High Level Group, the "take up of ICT is expected to impact on the economy and more in general on society" [30].

Replacing the i2010 initiative is the Digital Agenda as part of EU 2020. The Digital Agenda is one of seven initiatives in the EU 2020 growth strategy, which has initiatives grouped into three target areas - "Smart growth", "Sustainable growth" and "Inclusive growth" [31]. These initiatives include actions on education, youth, business/innovation, climate and inclusion. The EU has defined goals for the Digital Agenda and produces a scorecard demonstrating how each country and the EU in total are performing against these goals.

There is concern in the EU that a large part of the population is still unable to take advantage of opportunities offered by knowledge of technology, in particular people from disadvantaged groups such as the elderly or people with disabilities. The EU has declared its intention to ensure that "Every European (is) Digital" by 2015 and has an employment target for 2020 of 75% of the working-age population in employment. The working population is defined as those aged between 20 and 64 years. In order to reach the target an "Agenda for new skills and jobs" initiative was launched in 2010 [32] and digital literacy and e-skills have been included among the priorities of the initiative. These skills will be included in lifelong learning policies and actions will be taken in the areas of education and teacher training.

The Digital Agenda promises to "promote the take-up and use of the Internet in order to ensure inclusion in the digital society, namely through the extensive use of equipment and digital content and tools in education and learning, by enhancing digital literacy and skills and by improving accessibility for all, especially for persons with disabilities". Actions 57 to 68 of the Digital Agenda aim to increase e-skills and make digital literacy and competences a priority for the European Social Fund. These actions include addressing the competences of ICT users and practitioners, making digital literacy skills a priority and increasing lifelong learning and on-line education.

4 Digital Skill Frameworks

Digital skill frameworks can allow a person to understand the scope of digital skills and how they relate to soft skills. These frameworks are useful to allow a person to understand, and sometimes measure, their digital skills; examples include the European Computer Driving Licence (ECDL) (see www.ecdl.org); for ICT professionals there are the Skills Framework for the Information Age (see www.sfia-online.org) and the European e-Competence Framework (see http://www.ecompetences.eu/) and for organisations there is the IT-CMF Framework (see www.ivi.com). Many training and educational organisations use the frameworks to provide training, testing and certification [33]. In the United Kingdom, the Confederation for British Industry (CBI) has undertaken surveys to identify digital as well as other skills required by employers [34].

4.1 ECDL

ECDL, as a deliverable, was "one of the successful projects" within the European Union in 1997 and was reported as such to the European Commission at the end of the project evaluation. The programme has developed over the years in terms of numbers of users, contribution to skills and even contribution to the economy in some countries. In Greece, the ALBA industry study [35] looked at the cost of digital "illiteracy" with 140 people and found that they spent between 48 and 148 minutes per week trying to sort problems with office software. After ECDL training, the time spent on these problems was halved for word processing and spreadsheets and was reduced by over 90% for presentations and databases.

AICA, the Italian Computer Society, did a study in 2003 with Bocconi University [36] examining the cost of "digital ignorance". The study, using Italian 2003 pay rates, found that the cost of ignorance was over €2,200 per annum per employee. The Irish "Impact Report" [37], examining the people in the office sector in Ireland who had taken the ECDL programme, calculated that ECDL had generated "cumulative productivity saving of €186.9 million and currently generates annual productivity savings of €62.3 million for Irish employers in this sector."

4.2 Other definitions of digital skills

Three other frameworks that consider definitions of digital skills are considered here. The Joint Research Centre, Institute for Prospective Technological Studies (IPTS), produced a report in December 2013 [38] which assessed the frameworks in existence at that time. The research examined the knowledge, skills and attitudes required to be digitally competent and produced descriptors of digital competence.

The Microsoft Digital Literacy curriculum[4] has five parts. These are: Computer Basics; The Internet; Cloud Services and the World Wide Web Productivity Programs; Computer Security and Privacy; and Digital Lifestyles. Microsoft also provides certification at a professional level which includes the Microsoft Certified Application Specialist (MCAS) and the Microsoft Office Specialist (MOS).

The Global Digital Literacy Council (GDLC) created an e-skills standard called Certiport IC³ (Certiport Internet and Core Computing Certification). According to the GDLC web site[5], "You don't have to be focusing on a career in computers to benefit from IC³. Today, virtually any career or field of study requires the use of computers."

4.3 ICT professional skills

While all people need basic digital literacy skills, the skill needs for ICT practitioners are more comprehensive. Much work has been completed in creating a skills definition for the ICT practitioner. This includes the *European Certification of Informatics Professionals* (EUCIP) created by the Council of European Professional Informatics Societies (CEPIS); the *Skills Framework for the Information Age* (SFIA) created by a consortium in the United Kingdom (UK) which includes the British Computer Society and e-skills UK and the definitions created by Career Space in 1999 [39].

The framework (SFIA) has five areas, defined by the different capabilities required by an IT professional. The higher level skill areas are - Plan, Build, Run, Enable and Manage. There are 36 e-competences within these five skill areas. This framework was created by the European Committee for Standardisation CEN [40] to help a practitioner check his or her skills and identify gaps. CEPIS has recently used this framework to assess the skills of IT practitioners in Europe. According to CEPIS [ibid], "It is a reference framework of ICT competences that can be used and understood by everyone involved".

The original framework was created by CEN and published in 2008. It is now available as version 3.0 and claims "The European e-Competence Framework is a component of the long term e-skills agenda of the European Union supported by the European Commission and The Council of Ministers" [41]. The framework is available in English, French, German, and Italian and claims to comprise an agreed set of competences for ICT practitioners and managers and it "provides a European basis for internationally efficient personnel planning and development".

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4 http://www.microsoft.com/about/corporatecitizenship/citizenship/giving/programs/up/digitalliteracy/eng/curriculum4.mspxthe

5 http://www.certiport.com/portal/desktopdefault.aspx?page=common/pagelibrary/About_partners_GDLC.htm

5 Summary

There is a need for digital skills in all areas of employment. Computer awareness is necessary for all employees and technical skills are a requirement for those involved in developing and maintaining systems. E-leadership is a relatively new term, but is vital for competitiveness for companies operating in today's global business environment.

Much work has been done to develop frameworks to define the competencies needed. The following skills appear in some form in the frameworks examined:

Technical skills

> Technical skills range from being comfortable with technology to reaching the level of an IT practitioner. They all appear in some form on the skills' frameworks.

Information handling

> Information handling is an important part of digital literacy. The frameworks identify basic skills, from being able to locate and evaluate information to being able to create and synthesise information.

Communication

> The basic use of communication technologies is sending email and texts. Using social networking tools, collaborating and networking are also needed as part of a digital literacy definition.

Work-related skills

> The skills required will depend on the industry in which the person works and the level of seniority of the person in the organisation. For teachers, skills in IT are becoming vital, as a tool in teaching and as a subject to teach.

Personal attributes

> A person needs to demonstrate a large variety of "complex cognitive, motor, sociological, and emotional skills". Chief amongst these, perhaps, is the ability to anticipate and exploit rapid change to fulfil personal potential and for societal benefit.

Personal attitudes

> A person's attitude to technology will affect how he/she will use it. Most frameworks identify the need for acceptance of technology, the awareness of ethical and security issues and the ability to be critical, creative and innovative with technology.

According to the Organisation for Economic and Co-operative Development (OECD) [42] there is a worldwide demand for competent and skilled ICT practitioners and a demand for digitally literate people in all organisations and walks of life. "At the same time … [as the need for practitioners], the portfolio of basic skills needed to navigate ICT-rich environments and function effectively in our connected societies has expanded." With the rapid development of advanced automation and the increasing computerisation of non-routine tasks, including what is

regarded as ‘knowledge work’, these skills will continue to evolve and will require on-going re-evaluation.

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