

Digital Literacy – a driver for curriculum transformation

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Technological advances are dramatically changing the nature of employment, placing demands on higher education to ensure graduates are adequately prepared for working and participating in the digital economy. For this reason, it is necessary to critically review what is meant by digital literacy in a higher education context, and determine what skills underpin the term in order to inform curriculum transformation. Through a brief exploration of the term, it is apparent that there is no single shared understanding of what digital literacy entails, proving problematic for both students and teachers when attempting to scaffold and extend digital capabilities. Our understanding of digital literacy is continually changing in response to the dynamic nature of digital technology innovation. A shared and functional understanding of digital literacy is essential to developing graduate learning outcomes around digital skills and knowledge, allowing digital literacy to be scaffolded and developed through the curriculum. This paper explores digital literacy definitions and frameworks, and proposes a model which provides the foundation to drive curriculum transformation aimed at building graduates' digital capabilities.

Keywords: digital literacy, curriculum transformation drivers, learning outcomes, higher education.

Introduction

The European Commission (executive of the European Union) has been a leader in identifying the need for building capacity in the digital space since it identified digital competence as one of eight key competencies for lifelong learning in 2006. Since then, several European countries have made significant progress towards developing digital literacy and digital competency frameworks, policies and programmes, to ensure European citizens do not feel “left behind and marginalised by globalisation and the digital revolution” (European Union, 2007, p.1). Recently, Australia has recognised the significance of developing digital literacy and digital skills through the Australian Government's National Innovation and Science Agenda, which highlights the Government's commitment to digital education, particularly through its ‘talent and skills’ pillar, which aims to “support all Australian students to embrace the digital age” (Australian Government, 2015, p.4). Further to this, there has been substantial investment in programs to boost digital skills amongst young Australians through initiatives that aim to “increase the participation of all students and the wider community in science, technology, engineering and mathematics (STEM) and improve their digital literacy” (Australian Government Department of Education and Training, 2016).

The need for improved STEM skills is supported in the Australian Government's report on Digital Disruption (Productivity Commission 2016) which suggests that the pace and scale of technology adoption results in disruption which fundamentally changes the operations of the economy and society relatively quickly. The focus of the report is “on the role of government in the face of potentially disruptive technological change”, recognising that new technologies offer significant opportunities for the economy generally but also bring threats, particularly in

the rendering of skills and capital equipment obsolete. A recommended action for the Government is to boost STEM and entrepreneurial skills in order to “enable the workforce ... to adapt to future economic opportunities and the pace of technological change”. In parallel, the Government has recently adopted the Higher Education Standards Framework (<https://www.legislation.gov.au/Details/F2015L01639>) which requires explicit definition of course learning outcomes as well as effective scaffolding and support for student learning. Together these initiatives emphasise the value of a shared understanding of digital literacy and accompanying standards, in order to ensure that curricula are providing the opportunity for students to build 21st century skills to meet the demands of a digitally disrupted workplace.

Further to the Australian Government’s National Innovation and Science Agenda (www.innovation.gov.au), industry bodies including the Committee for Economic Development of Australia (CEDA, 2015), Foundation for Young Australians (FYA, 2014), and Deloitte Access Economics and Australian Computer Society (2015) highlight the need for higher education to respond to the fast-changing future employment environment. Graduates need skills related to using digital technologies creatively, effectively and independently in a digital world. A report recently published by the Commonwealth Scientific and Industrial Research Organisation (Hajkowicz et al., 2016) indicates that “to enter the labour market of the future Australians will need to be literate, numerate and digitally literate. These capabilities will be threshold requirements for most jobs” (p. 13). The report also suggests that:

While numeracy and literacy have long been on the radar for education providers, digital literacy is a relative newcomer. A challenge is the rapid change in computer software and hardware, which can make learned skills redundant. However, there are likely to be fundamental and enduring concepts of digital literacy which will be important for future job seekers to have mastered. (p. 13)

Although there is considerable emphasis on the need for digital literacy skills for individuals to be considered job-ready in future labour markets, there is little or no commentary on what these skills entail or how students are enabled to build digital competencies. Hajkowicz et al. (2016) are more specific, suggesting that “skills in computer programming might become essential for a wide variety of jobs” but are silent on what other skills digital literacy might demand. The European Computer Driver’s License (ECDL) Foundation (2016) are bolder, suggesting that the essential digital skills that are crucial for all people include skills and concepts relating to using technology but do not appear to address the broader concepts usually associated with digital literacy capabilities.

Ensuring learning is relevant to the modern, digitally disrupted world of work is a significant challenge that higher education institutions must address. As Johnson et al. (2016) suggest “the traditional view of literacy ... has expanded to encompass understanding digital tools and information” (p.24). This understanding of digital literacy (which includes digital skills and capabilities) needs to be integrated and contextualised into discipline-specific learning. Further, universities need to address this “new” competency through curriculum objectives and teacher training programs (Johnson et al. 2016).

It is an ongoing challenge for teachers and academics to recognise the foundation on which they are guiding students to scaffold and extend digital skills, and for employers to anticipate what level of digital literacy graduates are likely to possess. This issue is exemplified by one Australian university, whose articulation of the assumed digital literacy knowledge includes an expectation that students are able to use technologies to find, use and disseminate information;

access text, image and audio files on the web. Interestingly, this is referencing a graduate learning outcome rather than expected assumed knowledge (the knowledge that students bring into their studies). Further, it is unclear what the expectation is as it is open to widely differing interpretations. This can lead to confusion and misunderstandings, particularly between students and teachers (Røkenes and Krumsvic, 2014).

Despite the widespread use of the term there is no common understanding of what digital literacy means or what specific skills it entails. Johnson et al. (2016) indicate that “a notable obstacle to improving digital literacy is developing a consensus of all the elements it encompasses” (p.24). This has ramifications for all levels of education, as well as for employers and future students.

The growing ‘digital disruption’ of roles outside of the Information and Communication Technology (ICT) arena in the broader workforce requires a robust understanding and stable definition of digital literacy particularly with respect to digital skills, digital competency and digital capabilities. This paper explores some recent definitions of digital literacy from the literature, and presents a case for developing a common understanding. Recent work on perceptions of students’ capabilities is reported, providing a rationale for digital skills and capabilities development to be addressed in the curriculum. Recent benchmarks and frameworks for digital literacy are also explored, some of which have been developed for implementation in higher education settings. Finally, this paper proposes a model to scaffold digital literacy learning as one driver for curriculum transformation.

What is digital literacy?

Digital literacy was conceptualised as “the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers” (Gilster, 1997, p.1). The term has evolved as technologies have provided ever increasing capabilities for organisations, individuals and society in general. It now incorporates elements derived from other terms such as ICT literacy (the ability to use digital technologies), information literacy (recognising when information is needed, and the ability to locate, evaluate and effectively use it) and media literacy (the ability to access, evaluate and create media), amongst others (Gallardo-Echenique, Minelli de Oliveira, Marqués-Molias and Esteve-Mon, 2015). It is now used to describe anything and everything related to technology or computers. There are myriad terms used as synonyms for digital literacy and, depending on the background of the person using the term, as complementary to it (Lankshear and Knobel, 2008). It is interchanged with behaviours (for example using Facebook to communicate with friends), understanding how technology works (such as being able to purchase a computer to specification) and the role of technology in daily operations more broadly (including online shopping or accessing learning resources).

It is for this reason that digital literacy is hard to define. The complexity of the term creates challenges for educators who are responsible for equipping students for employment in the digital age, regardless of discipline. A student may need to know how to set up a wiki or maintain a blog if they are studying journalism, use Photoshop and curate images in Dropbox if studying creative arts, and commerce students may need to understand big data and data mining techniques. The complexity also poses challenges for students who are expected to acquire a somewhat unclear set of capabilities. These challenges are compounded as staff and students’ expectations are often not aligned, causing significant issues for both parties (Coldwell-Neilson, 2013). Despite the common use of the term ‘digital literacy’ there is

extensive research attempting to define and redefine the term, yet there is no common understanding of what it means. It is also unclear if this one term captures all facets of the literacy related to computing and computers (Belshaw, 2012), highlighting that the dynamic nature of the digital world requires continued discourse around meanings and interpretations not only to build, but also to maintain, a shared understanding.

There are several established definitions that are regularly cited in the literature. The American Library Association (2013) defines digital literacy as “the ability to use information and communication technologies to find, understand, evaluate, create, and communicate digital information, an ability that requires both cognitive and technical skills” for example. Another that is widely used in the UK and Europe is “those capabilities which fit an individual for living, learning and working in a digital society” (JISC, 2014). The former definition is closely aligned with Gilster’s definition, and is probably better termed ‘information literacy’. The latter is a rather more holistic definition which includes technical, socio-technical, cognitive and behavioural elements of digital literacy. However, neither definition captures the complexities of contextualising digital literacy within disciplines or professions, nor do they capture the elements of criticality, creativity and confidence which many researchers suggest are essential elements of digital literacy (see Belshaw, 2012 for example).

The need for a common understanding

Digital literacy is a 20th century concept in a technology-rich world. We use the term assuming that others have a common, shared understanding of the discourse, and promote it as an essential skill for all. It has also been identified as a “fourth R” (with reading, writing and arithmetic, the three Rs) (Wilson, Scaliseb and Gochyyeva, 2015). The three Rs are well understood with learning in these areas being built and extended throughout primary and secondary education, and beyond; definitions and scales of competency have been developed over a long time to create a common understanding of these basic skills. This is not yet the case with digital literacy.

The school system in Australia is trying to come to terms with incorporating digital literacy education in the curriculum. It appears as a component of the ‘technologies’ learning area in the Australian Curriculum (ACARA, 2016a) as well as a general capability, one of seven including literacy and numeracy. It notes that the teaching of digital skills is contextualised within disciplines, with general capabilities being addressed through the learning areas. It also notes that digital literacy should be included across the curriculum similarly to other foundation literacies.

However, the Australian curriculum is not implemented identically by each State education authority and has limited impact in Years 11 and 12 where each State-based authority retains control. Even with the construction of the national curriculum, there are still opportunities for variations to achieved learning outcomes. In any case, many higher education entrants do not use school standards to demonstrate assumed knowledge. In 2011, the Australian Bureau of Statistics indicated that approximately 40% of students were mature age (25 and over) and 30% were international students. This highlights a dependence on digital competence acquired through work and life experiences, or using international qualifications to demonstrate skills, making reliance on an established Australian school-based standard problematic. Many university programs with prerequisites have long-established methods for dealing with this

situation, however, since there is not yet a common understanding of what digital literacy entails or even that such an understanding is needed, such methods are not applicable.

To add to the confusion, the skill sets of digital literacy change as technology develops, with new technologies often requiring new skills. The introduction of touch screens for example, resulted in users changing from typing to swiping. Does the definition of digital literacy have to change to maintain alignment with current technology or do we need a definition that is independent of specific technologies? Gaining an understanding of the conventions associated with storing data for example, allows for better understanding of past, present and future data storage options as well as appreciating the myriad of issues associated with storing data digitally, including security and privacy. This can also be applied to other digital platforms such as social media, where the skills required to be able to use Facebook to communicate with friends are not necessarily sufficient to satisfy an employer's expectations of digital literacy and 21st century skills.

Perceptions of digital literacy expectations

While some universities have acknowledged the importance of digital literacy through the introduction of institution-wide digital strategies or graduate learning outcomes, it is still unknown whether or not graduates are wholly prepared for the workforce. Several studies have been undertaken to understand digital behaviours of students, their attitudes towards technology, and ability to use technology for an assigned task. While these are useful to understand behaviours and attitudes towards technology to help build engaging curriculum, they do not necessarily determine current levels of graduate digital literacy. Building digital skills requires effort at an institutional level, yet the lack of agreed definition of digital literacy makes it a challenge to transform curriculum effectively to develop digital literacy and capabilities in students.

Katz and Macklin (2007) pointed out that educators and employers tend to take for granted that students and graduates have critical information technology competencies, despite evidence to the contrary. A decade on, this still seems to be the case. In a study of 'almost' graduating students, Murray and Pérez (2014) found that "exposure does not equal understanding with regard to students' daily interaction with digital technologies" (p. 85). A recent study demonstrated that the "widespread access to and use of computers ... does not result in students increasing their computer study options or their level of computer literacy, rather the reverse is evident" (McLachlan, Craig, and Coldwell-Neilson, 2016).

Further to this, a number of studies have been conducted that suggest students' perceptions of their digital literacy skills far outstrip their capabilities (for example Phuapan, Viriyavejakul and Pimdee, 2016; and Ilamäki, Paavola, Lakkala and Kantosalo, 2016). Yet, the capabilities they do possess do not fall within those expected by employers. A study confirming these findings was conducted by the ECDL National Operators in a number of Nordic countries, to understand the digital literacy levels of students in their countries (ECDL, 2016). The study was conducted in two parts. Firstly students completed a survey that asked them to self-assess their digital capabilities based on the ECDL base modules (<http://ecdl.org/about-ecdl/base-modules>) which include the essential digital skills. Students then completed a practical test to discover their actual skill levels. A finding across the studies in all the countries was that digital skill levels are routinely overestimated by individuals. In the study 94% of participants described their skills as average to very good but just 39% demonstrated similar skill levels in the practical test. There is evidence to indicate that academics in Australia and elsewhere are

seeing this consistent overestimation of digital skills amongst their students, who seem to be the most comfortable with using mobile technologies but appear to be unable to transfer or contextualise those skills to other technology settings.

An “implied assumption exists that students graduating from university have attained skills and competence in information technologies, and as such, the university graduate is, by nature, digitally literate” (Murray and Pérez, 2014, p. 90). A result of this assumption is that employers have unrealistic expectations of the digital capabilities of graduates. These have been routinely reported, for example, in the annual Graduate Outlook report (GCA, 2014). University curricula are normally informed by university-level statements of graduate outcomes, in conjunction with requirements of specific professions through accreditation bodies and advice provided by industry advisory boards. Despite the plethora of information, the evidence is of a mismatch between employer perceptions of graduate outcomes and higher education expectations of graduate employability (for example Prinsley and Baranyai, 2015). This gap extends to foundation literacies including digital literacy which, as is argued here, is not well defined.

Informing curriculum: Digital literacy frameworks and benchmarks

The first step in addressing the mismatch between graduate skills and employer expectations is to build a shared understanding of what digital literacy is and the skills and competencies this literacy entails. A robust definition of digital literacy, together with a systematic model to incorporate digital capabilities within curricula, will provide a common foundation for institutions to drive curriculum reform. As recommended by the National Forum for the Enhancement of Teaching and Learning in Higher Education (2015) a “common language for core concepts relating to digital capacity building” (p.31) should be agreed.

The lack of an agreed definition of digital literacy creates a barrier for institutions to develop effective curricula to enhance and build digital literacy and capabilities in students. The current research highlights that there is still a considerable effort to be made in building digital skills and capacity in students and staff in higher education, requiring commitment at a management and institutional level (JISC, 2014).

A structured and cohesive approach is required to guide disciplines when incorporating digital literacy learning within their curricula, providing students the opportunity to develop skills and knowledge relevant to their intended industry. To this end a model is proposed for guiding the development of digital literacy skills in the curriculum (see Figure 1). A goal should be for graduates to be digitally fluent and have started to develop elements of digital intelligence. Broadly speaking, digital fluency includes technical proficiency, digital literacy and social competence (Spencer, 2015). Digital intelligence on the other hand, is “the knowledge and skills that will allow us to understand new technologies as they emerge, to identify the opportunities in them and manage the risks” (Waller, 2016). Similar to emotional intelligence, digital intelligence will grow over time, but graduates need to be at least aware of the need to be digitally (as well as emotionally) intelligent and what these intelligences entail.

A major outcome of the Fellowship program, which this research is part of, is to develop an understanding of, and benchmark for, digital literacy knowledge that students are expected to bring to their studies when entering higher education. As mentioned earlier, such benchmarks are common for the three Rs and for specific discipline knowledge expectations, but not for

digital literacy, although students are expected to be able to use technology creatively and competently to support their learning.

A recent review of publically available national and disciplinary Australian university statements on digital literacy for new and continuing students indicates that there appears to be no such measure (Coldwell-Neilson, 2017). ACARA does provide a benchmark for digital literacy in its “Technology-Digital Technologies” Learning area (ACARA, 2016b), and there are examples of ICT literacy frameworks (e.g. NAP – ICT Literacy Assessment Framework) that help define and assess ICT literacy levels in Australia; beyond this there is no current Australian benchmark for digital literacy. There are a number of benchmarks which have been developed in Europe and elsewhere that can provide the foundation for one suited to the Australian higher education context. For example, the European Computer Driving Licence is a technology benchmark that was developed through a collaboration between ECDL and the British Computer Society in the early 2000s and has been updated and extended to maintain relevance in the 21st century.

A framework which identifies the major elements that constitute digital literacy will guide the reforms that need to be addressed within curricula. Europe is quite advanced in developing digital literacy and digital competency frameworks that have a number of common characteristics and themes that this work can draw on. Structurally, frameworks have several levels or dimensions, such as the DIGCOMP framework (Ferrari 2013), or are represented visually as a map, for example the All Aboard Digital Skills interactive Metro map (<http://allaboardhe.org/digital-skills-framework/>) and the Mozilla Web Literacy framework (<https://learning.mozilla.org/en-US/web-literacy>). These highlight the complexity of digital literacy and how each component (e.g. information literacy, media literacy) continuously interact, overlap and intersect. There are also examples of discipline specific frameworks in higher education such as the University of Bath PriDE (Professionalism in the Digital Environment) project (<https://digilitpride.wordpress.com/digital-literacy-statements/>). All Aboard suggests that rather than ‘competency’ training, digital capacity is about “moving towards ‘confidence’ and nurturing opportunities for critical thinking, problem solving, creativity and innovation” (2015, p.5).

Building skills, capabilities and understanding involves extending students’ digital literacy knowledge from basic expectations (the benchmark) to a level that is expected for a graduate in the discipline. This cannot be achieved by simply adding skills to their portfolio but has to be scaffolded through each year level to develop digital fluency, through critical application of knowledge and begin to develop digital intelligence through understanding of use in a professional context. A possible tool to assist in this process is Beetham and Sharpe’s (2010) pyramid model of digital literacy development. Each of the four levels in the pyramid represent a stage in digital literacy development starting with “I have ...” access and awareness, “I can ...” which is related to skills, “I do ...” related to increasing proficiency, and finally “I am ...” which is to do with identity and professional expectations, enabling individuals to reach a level of fluency appropriate to their discipline in the workplace. The pyramid provides a means to model existing digital skills development in curricula and identify the gaps across the four levels, which can then be used for course enhancement and transformation.

The proposed model (Figure 1) is designed to be customisable for different environments and institutions. It is not specific about what any of the elements encompass. However, the first stage in the model is to develop a definition of digital literacy, a consensus from which the rest of the model can be built. Once a definition is agreed then a benchmark of digital skills will be

developed against which students can assess whether they meet any assumed knowledge requirements and teaching staff will be able to anticipate student capabilities.

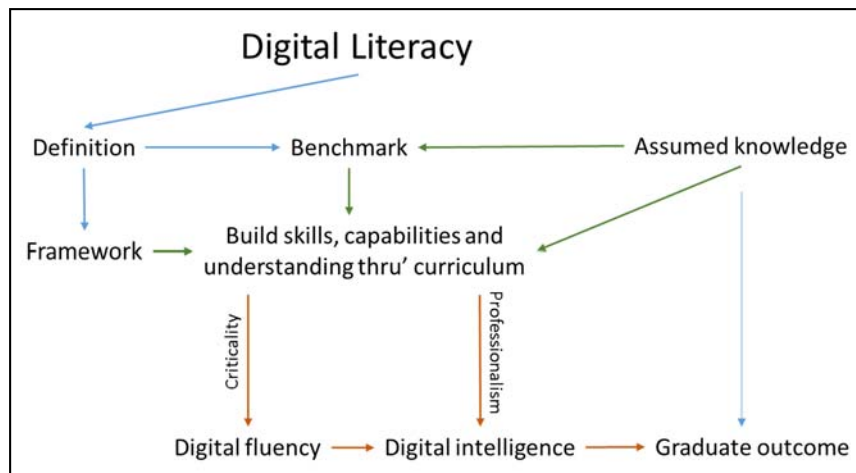


Figure 1 Digital Literacy transformation through the curriculum - a model

Concluding remarks

A recent report published by the Organisation for Economic Co-operation and Development states that:

Information and communication technology (ICT) has revolutionised virtually every aspect of our life and work. Students unable to navigate through a complex digital landscape will no longer be able to participate fully in the economic, social and cultural life around them (OECD, 2015, p.3).

The Foundation for Young Australians indicate that the future of work is being driven by three economic forces, automation, globalization and collaboration (FYA, 2015). They present a case for increased investment by Australian governments to ensure that the workforce of the future is digitally enabled. They estimate that over half of Australian workers will need to be able to use, configure or build digital systems in the next 2-3 years and a further 40% will require to have at least basic digital literacy skills. Gallagher and Garrett (as cited in CEDA, 2015, p.229) state that “technology-enabled HE [higher education] requires a mindset change for which universities must focus more strongly on what their students want and what employers are looking for in graduates.” This implies significant curriculum changes, driven by digital literacy learning, to ensure that graduates are adequately prepared to meet the requirements of their future employment.

By equipping higher education institutions with the means to provide a clear understanding of expectations of assumed digital literacy knowledge, disciplines will be able to plan how digital competencies are developed, extended and enhanced through the curriculum. This will in turn provide Australian graduates with the skills and capabilities necessary to be competitive in a global labour market that is increasingly becoming governed by international digital standards. As early as 2005, Prensky pointed out that “for the digital age, we need new curricula, new organization, new architecture, new teaching, new student assessments ... and many other elements”.

In their 2016 Horizon Report, the New Media Consortium suggests that a significant, yet solvable challenge is improving digital literacy. The report suggests that the “lack of consensus on what comprises digital literacy is impeding ... universities from formulating adequate

policies and programs that address this challenging issue". In 2017 improving digital literacy is still a significant challenge. However, the challenge has been given to institutions who are

charged with developing students' digital citizenship, ensuring mastery of responsible and appropriate technology use ... in blended and online learning settings and beyond. This new category of competence is affecting curriculum design, professional development, and student-facing services and resources. (Adams Becker et al., 2017, p.22)

In conclusion, this paper suggests a model that provides a driver for curriculum transformation through improvements in digital literacy learning. In order for curriculum to be transformed to meet industry's digital needs, a consensus understanding and benchmark of digital literacy is required, allowing graduate skills to be built from common foundations to be contextualised and understood further within disciplines.

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