

Digital Fluency: skills necessary for learning in the digital age

Dr Gerald (Gerry) White is a Principal Research Fellow at the Australian Council for Educational Research (ACER).

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In his recent book *Truth, Beauty, and Goodness Reframed: Educating for the Virtues in the Twenty-First Century*, prolific writer and psychologist Howard Gardner (2011) argues that, as a society, we need to decide what sort of society we want and what sort of people we want. These apparently simple questions are quite profound for education in the sense that decisions about what people learn and how people go about engaging with one another, in order to learn, come to the fore. The social institution of education may be society's answer to these questions but if that is the case then is education relevant for students today or does it need to change?

Technology has been changing the way that people learn and interact for thousands of years. Consider more recent historical innovations such as using maps which enabled sailors to navigate to new parts of the world, the telephone which enabled conversations over distance, radio which enabled broadcasting of sound, television that enabled broadcasting audio, visual and moving images, and now the Internet with all of its variations eg email, YouTube, Facebook, (Johnson, 2010). Innovations and inventions have encouraged the pace of social change throughout history, including in education. Now is no different, or have we become too entrenched in an obsolete system?

Many researchers argue that major innovations or inventions, especially the Internet, adopted by society, have an effect on the structure of the human brain (Carr, 2011; Cardinali et. al; 2009; Doidge, 2007; Kurtweil, 2005) which may or may not be a change for the better. Certainly, there is little doubt that the Internet, through its networked and mobile functions, has changed the way that people find information and the way that they communicate. If the structure of the human brain is changing due to new technologies such as the Internet, and locating information and communicating are changing, then changes to the way that students learn, and probably what they learn, would appear to follow.

This article examines the skills that will be required for the 21st century that will need to be embedded in educational curricula in order to achieve them. It begins by considering how communicating between people has changed and current educational responses. A view of 21st century skills follows with an argument for some core subjects that will be necessary. Learning and teaching are then discussed leading to a view about what is needed in order to develop digital fluency in education, for now and the future.

Communication

The history of communication as it has affected education was discussed in an interesting paper by James Bosco (2006) at an Australian elearning conference, the Global Summit. Bosco (2006) argued that early civilisations used verbal communications, and then passed on their traditions and culture verbally. However, in the fourteenth century print based communications emerged and in time came to dominate communication and recorded history. When education became universal in the nineteenth century, print was greatly valued and information was passed on both verbally and in print based artefacts. A form of scholarship emerged that was based on the printed form which continues to this day.

However, with the advent of the Internet and its accompanying digital technologies eg MP3, tablets, smartphones, then the verbal tradition of communication has reasserted itself together with text and visual communication. Text and images are transmitted today through digital media as well as in print. The fact that print newspaper sales are declining and Amazon.com sells more electronic books than print books indicates the importance of digital media, especially in education.

Curriculum

School education has responded to the application of digital media through a number of innovative programs such as Education Network Australia (EdNA) and the Digital Education Revolution (DER) in Australia, the Main Learning Technology Initiative (MLTI) (Silvernail & Gritter, 2007) in the US, and the National Grid for Learning (NGfL) in the UK, to name but a few. Although some of these eg EdNA in 2011 and NGfL in 2006, have now been closed, they remain as examples of national or State responses to the impact of digital media in education. So, how has the impact of digital media affected curriculum?

Curriculum in schools has often been defined as the knowledge, skills and attitudes that have been planned for student learning. However, Marsh (2009) gives some indication of the real problems that are faced in agreeing a definition of curriculum. He argues that some definitions are so broadly based as to be ineffective where others are narrow and restraining. Some are focussed on 'content, others on the contexts and yet others are focussed on the strategies to use' (Marsh, 2009, p. 5).

However, a discussion about the changes that may occur in school education would not be complete without considering curriculum. In order to avoid the dilemmas of defining curriculum together with the controversies that surround each view, and to approach the use of digital media in a realistic way, this article discusses curriculum differently. It will examine what should be learnt, why it should be learnt, how it can be learnt, when and where learning takes place and how we can measure learning.

Bosco (2006) argues that what should be learnt is a political decision which would appear to be borne out by the Australian Curriculum (<http://www.acara.edu.au/curriculum.html#2>) which has focussed on content. The Australian Curriculum is guided by the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008) which nominated eight areas of curriculum: English, Mathematics, Sciences, Humanities and social sciences, The Arts, Languages, Health and physical education, and Information and Communication Technology and

design and technology. The Australian Curriculum and Assessment Authority (ACARA) utilised these general MCEETYA capabilities with the view that, ‘good teaching will always contribute to a student’s development of general capabilities’ (ACARA, 2011) and added that these, which include ICT, would be incorporated into each learning area content descriptions as appropriate.

The ACARA general capabilities comprise the following:

- Literacy
- Numeracy
- Information and communication technology competence
- Critical and creative thinking
- Personal and social competence
- Ethical behaviour
- Intercultural understanding. (ACARA, 2011).

There is no doubt that these general capabilities are important as skills for the twenty-first century.

Twenty-first century skills

The question that is raised by the current focus on content followed by a statement of the above general capabilities is, ‘What should we learn and what do we need to know to be a participant in 21st century society – that is, a globally connected society?’ A number of projects have begun to grapple with this type of question, three of which will be mentioned here.

The first is the *Partnership for 21st Century Skills* founded in 2002 in the USA by the US Department of Education¹ with a number of large corporations. The partnership consulted widely and developed a thorough framework of skills needed by learners for the twenty-first century. The framework² of twenty-first student outcomes can be summarised as including four major areas which are:

1. Core Subjects and 21st Century Themes
2. Learning and Innovation Skills
 - Creativity and Innovation
 - Critical Thinking and Problem Solving
 - Communication and Collaboration
3. Information, Media and Technology Skills
 - Information Literacy
 - Media Literacy
 - ICT Literacy
4. Life and Career Skills

¹ US Department of Education at <http://www.ed.gov>

² The Partnership for 21st Century Skills framework can be accessed at http://www.p21.org/documents/P21_Framework_Definitions.pdf.

Although the traditional skills remain important in this framework, a range of new skills such as critical thinking, problem solving, communication and collaboration are asserted as important in the digital age. The framework is completed with consideration of support systems such as standards, assessment, curriculum and instruction, professional development and learning environments. The *Partnership for 21st Century Skills* brings these skills and content together in a statement of *Curriculum & Instruction*. The statement is clear that twenty-first skills need to be explicitly taught, within other disciplines or as a discipline in their own right.

A second group is the not-for-profit *Project Tomorrow*³ of universities, colleges, businesses and foundations. *Project Tomorrow* is responsible for conducting national research projects such as *Speak Up*, a national online survey of teachers, students and parents. In their *Speak Up 2010 National Findings: K-12 Students and Parents* (2011) report, a number of trends were identified such as the prolific use of mobile devices including the use of e-textbooks, and the use of online and blended learning enabling ‘a greater personalization of the learning process and facilitates opportunities for students to collaborate with peers and experts’ (Project Tomorrow; p. 9). These skills and the implications of their use by students need to be learnt in a structured way to avoid difficulties for students, teachers and parents. However, a sobering thought is the widely divergent views of teachers and students about the importance of developing information and literacy skills (Project Tomorrow, p. 9). The report concluded that the new three E’s of education are ‘enabled’, ‘engaged’ and ‘empowered’ which ‘paints a picture of the learning process for students that is visually and structurally very different than which most students encounter in school today (Project Tomorrow, p. 14). Students can make the most of opportunities to personalise their learning, if they have the necessary skills required in a networked world. These skills need to be learnt in a developmental and structured way.

In the *Speak Up* report *Learning in the 21st Century: Digital Experiences and Expectations of Tomorrow’s Teachers* released in 2013, *Project Tomorrow* provides evidence of the experiences and expectations of tomorrow’s teachers. They include the capacity for teachers to be technologically savvy in both their personal and professional lives so that 21st century skills can be taught effectively.

A third major international project, the *Assessment and Teaching of 21st Century Skills*, has provided a strong research base in order to identify and define 21st century skills. Their conclusion (Binkly et al., 2012, p. 18-19) shows the following ten skills, organised into four categories, as necessary for 21st century learning.

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| <p><i>Ways of Thinking</i></p> <ol style="list-style-type: none"> 1. Creativity and innovation 2. Critical thinking, problem solving, decision making 3. Learning to learn, Metacognition <p><i>Ways of Working</i></p> <ol style="list-style-type: none"> 4. Communication | <p><i>Tools for Working</i></p> <ol style="list-style-type: none"> 6. Information literacy 7. ICT literacy <p><i>Living in the World</i></p> <ol style="list-style-type: none"> 8. Citizenship – local and global 9. Life and career 10. Personal and social responsibility |
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³ Project Tomorrow at <http://www.tomorrow.org/index.html>

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|-----------------------------|--|
| 5. Collaboration (teamwork) | – including cultural awareness and competence. |
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There is a strong resonance between the twenty-first century skills in all three of these major projects.

Core subjects

The *Partnership for 21st Century Skills* began by nominating ‘core subjects as a major area of skills learning. In Australia, literacy (reading, writing and language conventions-spelling/grammar/punctuation) and numeracy have been regarded as fundamental skills for all students to learn and master (ACARA, 2011). In fact, the *National Assessment Program - Literacy and Numeracy*⁴ (NAPLAN) program tests all Australian students in years 3, 5, 7, and 9 each year in the areas of literacy and numeracy and the results for each school are then posted on a public website⁵. The importance of literacy and numeracy in schools has been highlighted since 1998 (MCEETYA, 1998) when a national program began.

English as a language is a human evolved system that represents sounds with recorded graphics or symbols in order to communicate ideas, concepts and understandings. As such it is fundamental to the very fabric of a knowledge society especially as technology and transport enable global communication and exchange. Facility with the English language in order to engage fluently with the written word becomes the basis for literacy skill. Freebody (2007) argues that there is a strong correlation between aspects of literacy and material wealth and socio-economic status (p 24).

Indeed, Freebody (2007) highlighted the importance of literacy education in schools when he stated that:

Fluency with... English and understanding everyday texts are necessary parts of the development of the powerful literacy capabilities that contemporary schooling call for, and are necessary precursors to a generative process whereby individuals and collectives can actively and effectively participate in domestic, civil and vocational life
(Freebody, 2007, p. 67).

Numeracy, similarly to English, is a human evolved system and, as a part of fluency with number in mathematics, has evolved in order to understand order, pattern and quantity in the environment. It has become increasingly important in a global knowledge society as Rubinstein (2009) suggested:

Mathematics isn’t just important. It is a critical skill that every Australian citizen should be able to develop in order to improve their lives and the lives of those around them. Mathematics enables technological innovation in our world. It is elemental to all forms of commerce. It is the foundation upon which all sciences and all areas of engineering depend.
(Rubenstein, 2009).

What is being argued here is that both literacy and numeracy are both human developed systems that continue to evolve and change. They involve learning fundamental skills in

⁴ National Assessment Program at <http://www.nap.edu.au/>

⁵ MySchool website at <http://www.myschool.edu.au/>

order to engage with and take part in a global knowledge society. Although literacy and numeracy achievement are often regarded as indicators of the health of our education system, this superficial view ought not to detract from the importance of each. However, education involves much more than literacy and numeracy, and today is being challenged by many competing demands, not the least of which is the compelling and advantageous use of digital media that open up new areas for learning.

The discussion so far gives an indication of a broad view of skills needed for the twenty-first century with the added contention that literacy and numeracy are fundamental. That is, they are fundamental as building blocks for the types of twenty-first skills that are necessary to engage with a knowledge society. So, what should students learn that is specific to the Internet and what do teachers need to do?

Learning 21st century skills

There is no doubt that digital media and the Internet have changed the way that people access information and communicate with one another. The Internet is so prolific that it has become a global phenomenon. The Australian Bureau of Statistics (ABS) reported in the *Australian Social Trends June 2011* (ABS, 2011) statement titled *Children of the Digital Revolution* that children under 14 years of age spent most of their time using the Internet on educational activities, followed by games, social networking and finally, music.

Clearly, 21st century skills are being learnt at random and possibly in harmful ways by children who are Internet users. The Australian Parliamentary report *High-Wire Act: Cyber-Safety and the Young* (Commonwealth of Australia, 2011), completed after wide national consultations, was very clear about a number of safety issues that needed to be addressed. They included cyber-bullying, online grooming and secreting; illegal content such as pornography; cyber-stalking; addictions such as gambling, drugs, violence, suicide and anorexia; privacy and identity theft; inappropriate behaviours; identities; personal information sharing; how and what to share; and critical thinking and risk (Commonwealth of Australia; 2011).

This long list of items and skills to be learnt, in order to maximise the beneficial uses of the Internet, are only those that may have an impact on safety. There are many other specialised Internet issues to be learnt as well, in order to maximise the positive use of the Internet for learning. The question of perspective becomes an issue when considering teaching twenty-first century skills and especially in relation to the use of digital media.

The International Society for Technology Education (ISTE) has provided a learning perspective in three well considered documents that outline the skills and conditions for successful educational use of ICT in schools. The booklets under the banner of 'standards' focus on the skills and knowledge that students, teachers and administrators will need to learn, to teach and to build a learning culture for the digital age. These national education technology standards (NETS) for students (ISTE, 2007), teachers (ISTE, 2008) and educational administrators (ISTE, 2009) developed by experts in the use of ICT in education, reinforce the advice from other bodies such as the *Partnership*

for *21st Century Skills* that there are new skills that need to be learnt to maximise the use of ICT in teaching and learning.

Teaching 21st century skills

The teaching aspects of the curriculum have been centred on the content to be learnt and the learning process in the context of a learning environment or pedagogy for many years. Teachers are familiar with the finer details of the content that they teach and the learning methods that they employ, and are constantly seeking to improve both content and pedagogy. This was often discussed as pedagogical content knowledge (Shulman, 1987). However, content and pedagogy are no longer sufficient in a digital world because there is now a technological dimension for accessing information and for communicating.

The technological aspect was emphasised by Koehler and Mishra (2008) who introduced a way of conceptualising teaching in the digital age by arguing the need for technological pedagogical content knowledge. Their acronym TPCK, now modified as TPACK, underlines the technological, pedagogical and content knowledge that is fundamental for teachers in the digital age. In fact, TPACK is now argued by Finger (2010) et al. as necessary as standard for teacher education and if that is the case, then TPACK is also essential for teacher professional learning. A good starting point for teachers is the technological, pedagogical and content knowledge (TPACK) necessary for teaching in the digital age.

Mark Pegrum (2009) also discusses a number of perspectives as lenses through which education can be seen as including technological, pedagogical, social, sociopolitical and ecological lenses. These are important to understand because the educational context in which digital access and use operates occurs within such a framework. Educational leaders wishing to move to a twenty-first century learning environment will need to take into account each of these perspectives, in order to build a learning culture within their school community in the digital age.

The question remains about how education can change existing teaching practice to utilise TPACK and the perspectives that leaders need to embrace for teachers and students to become fluent in the use of digital technologies. Mitchel Resnick et al. (2002) argued that the pervasiveness of digital technology will be necessary for a lifetime. In moving beyond information-centric views of education, Resnick (2002) stressed the importance of being fluent in using multimedia, when he stated that:

In the years ahead, digital fluency will become a prerequisite for obtaining jobs, participating meaningfully in society, and learning throughout a lifetime. (Resnick, 2002, p. 33)

Resnick (2002) went on to say that students would need to be fluent online, with the web, text, audio, animation, video, remixing, design, downloading and uploading, and fluent in critical thinking, collaboration and deciding relevancy.

Since the early 1990s, the ubiquity of digital devices and services (ABS, 2011), the proliferation of web based information sources and the always-on nature of communication have been seen as major changes to the way that people access and apply information, and network socially. As explained above, there are a host of new skills to learn in order to maximise these digital technologies and networking socially, as well as for learning. However, in an industrially developed and maintained school system, teaching and learning these new skills is unlikely to occur unless it is planned and resourced by educational authorities. This article suggests the need for a K-12 digital fluency subject, the elements of which are outlined below.

Digital fluency

A suggestion of topics to be covered in a K-12 education subject, for the effective use of the Internet for learning, takes into account the skills that are needed to successfully use digital technologies for learning eg critical thinking and collaboration. It also includes aspects of online safety and legal issues such as copyright and privacy. The following suggested topics for a digital fluency K-12 subject have been listed in alphabetical order.

- Acceptable behaviour
- Collaboration, communication, problem solving and research skills
- Community involvement
- Critical thinking
- Design skills
- Digital commons and copyright
- Digital fluency
- Ethics
- History of the Internet
- Identity and privacy
- Project management
- Safety
- Technology terms

The benefits of such a subject would be to begin to address the skills and safety issues that are needed by teachers and students in the digital age, in order to engage in learning programs that are connected and current. No-one would argue that technology is the single most important factor in learning because the research is quite unequivocal that quality teachers and quality teaching have the most significant effect (Hattie, 2009). However, in the hands of quality teachers who engage in a supportive learning environment, the gains from using digital technology are well documented. A subject on digital fluency from K to 12 would also help to determine the knowledge, skills and attitudes that need to be measured in order to gauge successful and safe use of the Internet.

In fact, Tamim et al. (2011) have completed a second-order meta evaluation of educational research that has covered the last forty years of technology use in education and found that, 'the average student in a classroom where technology is used will perform 12 percentile points higher than the average student in a traditional classroom setting that does not use technology to enhance the learning process' (p. 17). The need to

teach students the knowledge, skills and attitudes necessary for the digital age is beyond question.

Conclusion

This article argues that the knowledge, skills and attitudes that are needed to harness the new digital media for teaching and learning in the digital age are an extension of many traditional skills but with the complex addition of new skills and a changed focus. These new skills and understandings often occur in a context that is quite different from the centuries old traditional print based context, with which is linear and with which education is so familiar.

In an industrial-age designed subject-based education system, where change is slow, these new knowledge, skills and attitudes are becoming increasingly urgent for students to acquire. However, teaching and learning these new skills, and different ways of working with information and communicating, need to be based on sound evidence and positive educational experiences. This article argues that a subject called digital fluency is one, and maybe a significant way, to address the urgency of the digital age skills gap. Mounting a subject such as digital fluency in K-12 education will help to address the issues of professional learning, teaching pedagogy as well as assist students to learn new skills in a structured way, so that these new skills can be applied, at random, whenever the Internet is being used.

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