Digital technologies: Implications for educational organisations and settings in the twenty-first century

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Abstract

This article investigates the ways in which digital technologies now commonly available and in use can be used to support learning in educational organisations and settings (and change the nature of provision in some instances). A transformation in the attitude and behaviour of teachers, it is argued, is required if the possibilities and opportunities offered by digital technologies are to be maximised now and into the future. In reaching this conclusion the paper examines a number of barriers to change and explores relevant theories of learning that should lead to the situation whereby teachers cannot imagine a world without maximal use of the digital devices that are now available to all learners for whom they have a responsibility.

Introduction

The term 'digital technologies' in this article refers to multi-functional devices with Internet connectivity, particularly those that are handheld and portable. There is now widespread recognition that such equipment presents opportunities to change the way in which student learning can be organised. Traxler (2010) suggests everyone typically now owns one, uses one and often has more than one such device. As a consequence, it has been argued that the availability of such devices has the potential to change the traditional dynamics and patterns of the learning environment. The combination of more traditional Internet access (fixed location) and personal Internet access (mobile) thus provide the opportunity for educators to explore a number of trends in this new era. This article seeks to explore the implications of such technologies for educational organisations and settings at all levels of provision.

Education in the 21st Century

Despite living in changed world where information is more readily and easily accessible than at any time in history, most methods of encouraging learning in formal education still depend on the immediacy of the teacher-student interface and particularly those that are enacted in a shared physical environment. Furthermore, the purposes of education commonly remain ill-defined with an emphasis on attainment of prescribed learning outcomes rather than the development of a skill-based curriculum designed to deal with a rapidly changing world. Central to the twenty-first century learning environment, however, is access to digital technologies which are becoming increasingly personal, powerful and holistic in their capacity to access information. As Gordon (2014: 3) notes, "technology is no longer innately innovative or new" and "learners expect to encounter technology in school, college and work environments". Most education organisations and settings typically have not managed to have adapted to these developments at present, however, with student learning environments still bearing a worrying correspondence to those used in the previous two centuries of universal basic education and an increasing post-compulsory sector. This paper thus begins with a discussion about the purpose of formal education in the current era before examining ways in which access to readily available information have influenced and even changed the nature of knowledge. Both these influences have implications for educational organisations and settings in the context of the twenty-first century which will be examined in the final part of the article.

The principal concern arising from this discussion is the role of the teacher and their relationship with the student, with the balance of arguments indicating a need to

provide the learner with greater control in a digitally enhanced environment. Consequently, the key issue arising from such a scenario is the notion of flexible learning which, it is determined, should lead to a revision of teaching strategies at the very least. Traditional teacher led environments, it will be argued, should move from direction and control to facilitation and guidance of learners, a process requiring new skills and knowledge on behalf of staff charged with leading student learning. This has been described as the transition of teacher from "sage on the stage, to guide on the side" (King, 1993: 30).

Purposes of formalised education

A journey back through several centuries would demonstrate that very few of the world's population would have participated in any educational environment outside of their home or local community. It was not until the latter stages of the nineteenth century that universal basic education become available for the population of the more advanced economies, although this ambition became more prevalent globally during the last century. By the end of the last century there was conflict as to the purpose of such provision, however, with views ranging from bringing "people to as full a realization as possible of what it is to be a human being" (Foshay, 1991: 277) through to producing a capable workforce. In most circumstances, however, it seems that ambitions for formal education have been most closely linked with national economic aspirations rather than with a neo-liberal approach to learning. Indeed, such ambitions are still evident in the current era with UK Schools' Minister Nick Gibb declaring, "education is the engine of our economy, it is the foundation of our culture and it's an essential preparation for adult life" (Department for Education, 2015).

The notion that formalised education primarily has an economic function can be seen in the way that governments seek to emulate the attainment of students in perceived higher achieving nations on internationally recognised standards of success. Typical in this regard is the emphasis on school age student scores on the Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Scores (TIMSS) and Progress in Reading Literacy Study (PIRLS) where government policies link performance on the attainment levels with long term economic advantage. Similarly, graduate levels have also been linked with national economic viability as measured through growth of gross domestic product (Department for Business Innovation and Skills; 2013, 2016). Despite there being substantive critiques of the use of such data (e.g. Carnoy, 2015) their credibility remains high in educational policy and particularly in the UK. This argues Ma (2016: 2) has skewed student focus in higher education towards learning outcomes rather than learning and has manifested itself "in students' preoccupation with final grades at the expense of the dialogue that tutors attempt to set up with them through assessment", leading to a situation where there is "displacement of academic rigour in favour of performance indicators that can form an impasse to students' intellectual development". This, he argues, has led to "the eroding of learner autonomy and ultimately the digression of students from developing independent thought in their chosen subject". Similar critiques could be made toward compulsory education with multiple contributors, including seminal work from Reimer (1971), illustrating a need for a wider perspective than just the transmission of knowledge and the use of schools as agents of society.

It would be unfair not to return to the statement of Nick Gibb above (Department for Education), however, as he also highlighted the need for formalised education to be the foundation of national culture and a preparation for adult life. The challenge we face in the twenty first century, however, is that we neither have the stability of culture that was a feature of previous times, nor does the way forward to adulthood have clarity of vision. In many ways this emerging scenario has more to do with the way in which knowledge is formulated and verified than it does to patterns of social unrest. Before the middle of the last century it was recognised that knowledge was no longer permanent and guaranteed to exist beyond the span of a single life time as "today this time-span is considerably shorter than that of human life, and accordingly our training must prepare individuals to face a novelty of conditions." (Whitehead, 1931: 10).

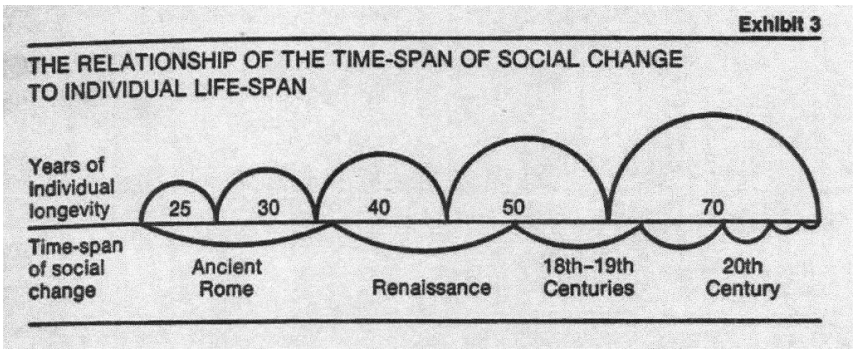


Figure 1: Major cultural changes and the life-span of individuals (Whitehead, 1931)

Consequently, we are now in an era where predictions of what national culture will look like in the future and how adult life will unfold are speculative at best. Processes of globalisation have narrowed the prospect of predominant individual national cultures and, with the world's technological capacity to store information having roughly doubled every 40 months since the 1980s (Kitchin, 2014), we no longer have control of knowledge that will be sufficient for life. In terms of digital technologies in the twenty first century, for the first time today's parents and teachers have little, if any,

experience with the tools that children are going to use every day in their adult lives (Organisation for Economic Cooperation and Development, 2015: 186).

Education in a digital age

We are, suggests Edge (2104), fast approaching the era of Generation 'Z' who, although not yet in the workforce, will be the demanding population of the future. Educational provision is largely being organised and run currently by 'Baby-Boomers' (those born between 1946 and 1965) and delivered through members of Generation 'X' (1966-80) and Generation 'Y' (1981-1995). By no means is the current population of educational leaders technologically capable in the way that the more recent generations of adults as they "were 'socialized' [to digital technologies] differently from their kids, and are now in the process of learning a new language" (Prensky, 2001: 2). Those baby-boomers that have made the transition to technological capability were described as 'digital immigrants' by Prensky (2001), whilst he labelled subsequent generations as 'digital natives', who were later described as "extremely techno-savvy" (Edge, 2014: 140). Newer generations, argues Prensky, have thus grown up in a world where digital devices are a core feature of their lives who have spent more time playing video games and watching television than reading and for whom the Internet, personal handheld (or wearable) devices and instant messaging are integral parts of their lives. Thus the student body creating new demands is Generation 'Z' (1995-2003) who, suggest McCrindle and Wolfinger (2010), not only have access to and embrace almost all digital technologies, but are also are highly dependent on the Internet and take it for granted. As illustrated above, however, the education workforce tends to lag behind with Prensky (2001: 2) suggesting "the single biggest problem facing education today is that ***our Digital Immigrant instructors, who speak an***

outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language" (original emphasis).

In too many instances, however, the education workforce seemingly seeks to manage the use of digital devices in formal learning situations in ways that deny the normal lifestyle of students in this century. In these circumstances one of the major restraints emanates from issues relating to e-Safety, particularly in pre-school settings and compulsory education. The ogre of e-Safety in schools is often manifested by introducing firewalls and regulations that prevent or discourage student use of digital technology, especially in the formal face-to-face learning environment, resulting in the notion of 'access denied' (Male and Burden, 2014: 424). Even then, where there is evidence of willingness to engage with digital technologies, Westberry, McNaughton, Billot and Gaeta (2015: 101) found "teachers can be sceptical of the pedagogical value of technology, using it in limited ways rather than engaging in significant curriculum change [or] to repackage existing pedagogies as teachers use technology to support their existing beliefs and practices".

'Traditional' versus 'Flexible' Learning

This resistance to adaptation appears manifested in the manner in which teachers are perceived to be the principal source of knowledge in the learning environment. Traditional methods of training and education have tended to be based on the transmission of knowledge from 'expert' to 'learner' though the construct of a discipline. Thus we have teachers, for example, steeped in mathematical competence and knowledge attempting to transmit key mathematical concepts to learners. As a process of education this is deeply flawed, but to successfully sustain such an

evaluation there is a need to establish what is meant through offering phrases such as 'developing an effective learning environment'. Firstly, there is no guarantee that being a mathematician qualifies that person to impart and develop mathematical capability in others. What is needed for such a transition is the capability to engender learning in others and for this, dependent on age and circumstance of the learner, is the pedagogical, andragogical or heutagogical capability of the teacher.

In previous times the focus has been on pedagogy (leading a child), but during the last century the notion of andragogy emerged and, more recently, the concept of heutagogy has appeared. Simply explained, andragogy is the notion of adult as a learner with a shift from "transmissive pedagogies, where the main focus of its action is to transmit knowledge to learners, to participatory pedagogies" (Male and Palaiologou, 2015: 218). In this mode the adult, as learner, becomes a partner in the learning process rather than just a participant. Heutagogy, however, is the concept of a self-directed learner (Hase and Kenyon, 2001) who has the agency (and means) to be successfully engage in directed independent learning opportunities (Thomas, Jones and Ottaway, 2015). In such a learning environment students are:

> guided by curriculum content, pedagogy and assessment, and supported by staff and the learning environment, and […] play an active role in their learning experience – either on their own, or in collaboration with peers. They are supported in their independent learning by learning resources, including libraries, online materials and learning environments, physical learning spaces; and by the development of their academic capacity either through the core curriculum or through additional support services. (Thomas et al, 2015: 7)

With the shift from a pedagogical/andragogical (teacher-centred) through to a heutagogical (student-centred) approach there is a recognition that a "discipline based knowledge is inappropriate to prepare for living in modern communities and workplaces, [that] learning is increasingly aligned with what we do, [that] modern

organisational structures require flexible learning practices and there is a need for immediacy of learning" (Hase and Kenyon, 2001: 2). Such latter assertions require justification, however, as they tend to diminish the role of teacher and amplify the notion of an emergent, self-disciplined learner. So how are such assertions justified?

The answer appears to lie in the concept of knowledge, and its creation, in the age of digital technologies where access to information is so readily available to all through the Internet. Whilst it is recognised that information is not knowledge, anyone with appropriate equipment can now search through open data sources to engage with ideas, theories and discourse over what is 'true' and what is 'real'.

The importance of the Internet to learning in the twenty-first century

In its original form (Web 1.0) the Internet was used by a relatively small group of people in a 'delivery and receipt structure' as it only permitted a one-way flow of information and service to the end user (Crook, 2008). This meant that 'knowledge' was created and validated by experts and was akin to being an online encyclopaedia. Users were able to read the content or information in the database, but typically were unable to contribute or add to this knowledge repository. Burden (2012) suggests, however, that evolving versions of the Internet (Web 2.0 and 3.0) were more open systems, based on principles of 'read and write' access with potential for user participation, irrespective of perceived or actual expertise, thus becoming more democratic. Control of 'knowledge' has thus moved from a small elite to agreed discourse, at best, or competing 'truths' where disagreements, dogmata or political interventions are evident. Additionally, the Internet has begun the process of fostering social interaction and knowledge representation based on multi-modal representations including

images, video, audio and combinations of such media. This is turn has transformed the kind of social interaction possible over the Internet making it feasible to undertake discourse and dialogue without having to rely on text based mediation (Male and Burden, 2014), consequently:

> The online world has redesigned communication in and outside the workplace; anyone can access almost anything about a topic, so [young people] are now accustomed to accessing mutliple open sources of information for solutions. As a result there are more collaborative technologies that have enabled the learning process to evolve from a fixed series of discrete training events into an informal, ongoing experience. Learning can easily occur anytime, anywhere and in a variety of formats. (American Society for Training and Development, 2009: 3)

Web 1.0 / 2.0 / 3.0 Summary

Crawl	Walk	Run
Web 1.0	Web 2.0	Web 3.0
Mostly Read-Only	Wildly Read-Write	Portable & Personal
Company Focus	Community Focus	Individual Focus
Home Pages	Blogs / Wikis	Lifestreams / Waves
Owning Content	Sharing Content	Consolidating Content
Web Forms	Web Applications	Smart Applications
Directories	Tagging	User Behavior
Page Views	Cost Per Click	User Engagement
Banner Advertising	Interactive Advertising	Behavioral Advertising
Britannica Online	Wikipedia	The Semantic Web
HTML / Portals	XML / RSS	RDF / RDFS / OWL

Figure 2: The Changing Nature of the Internet

Further developments to technology, particularly in terms of portable devices, which invariably include live streaming in all aspects of life and personalised provision (e.g. behavioural advertising and learning analytics), present the inevitability of a "fundamental change for education, shifting from passive acquisition of someone else's ideas to active learning experiences that empower people to inquire, critique, create, collaborate, problem-solve and create understanding" (Dede and Barb, 2009).

Implications for educational organisations and settings

Education organisations and settings, however, typically remain organised around spatial and temporal considerations such as between the community, parents, students and school buildings, timetables, calendars and internal structures which are designed to classify and manage students (Male and Burden, 2014). Digital technologies, however, offer the potential for different forms of learning and teaching to occur both synchronously and asynchronously. This can afford learners more, and better, time for engagement than traditional learning spaces where responses and feedback are expected more immediately (Zieghan, 2001). Digital technologies thus offer new opportunities as to how learners undertake personal research or inquiry in the face of unprecedented access to information and sources of data (Crook, 2008). Such technologies are a core feature of the current era, therefore, which thus presents the possibility for a shift from passive acquisition of someone else's ideas to active learning experiences that empower people to inquire, critique, create, collaborate, problem solve, and create understanding (Dede and Barb, 2009).

Developments in digital technologies thus allow for the possibility of using personal devices more extensively in planned student learning experiences which, in many

instances, will involve accession to the principle of Bring Your Own Device (BYOD). Intel, the major computer memory company, first coined the term in 2009 when they observed that an increasing number of its employees were using their own devices and connecting them to the corporate network. Since implementing BYOD policies the company reported up to 5 million hours of annual productivity gains, a statistic that is compelling many other organisations to consider a similar policy (Johnson, Adams-Becker, Estrada and Freeman, 2015).

Whatever the device that is employed by students, however, the opportunities offered through personal Internet access offer 'pedagogical affordances', a term used in the context of digital technologies to explain and predict the potential for adapting teaching and learning strategies (Burden and Atkinson, 2008; Conole and Dyke, 2004). Tools such as wikis, social networking software and aggregator services are identified as the means by which educators might shift the emphasis of their teaching by empowering the student to see themselves as knowledge co-constructors rather than passive recipients of information provided. In an era when knowledge is no longer fixed and is subject to challenge on the very public platform of the Internet students need the skills to explore and synthesise data in order to determine knowledge and construct meaning.

As an example the interactivity of social media provides one way for educators to change educators work with their students. The implication for education organisations and settings, it is reported, could be that:

> Social media enables two way dialogues between students, prospective students, educators, and the institution that are less formal than with other media. As social networks continue to flourish, educators are using them as

> professional communities of practice, as learning communities, and as a platform to share interesting stories about topics students are studying in class. (Johnson et al, 2014: 8)

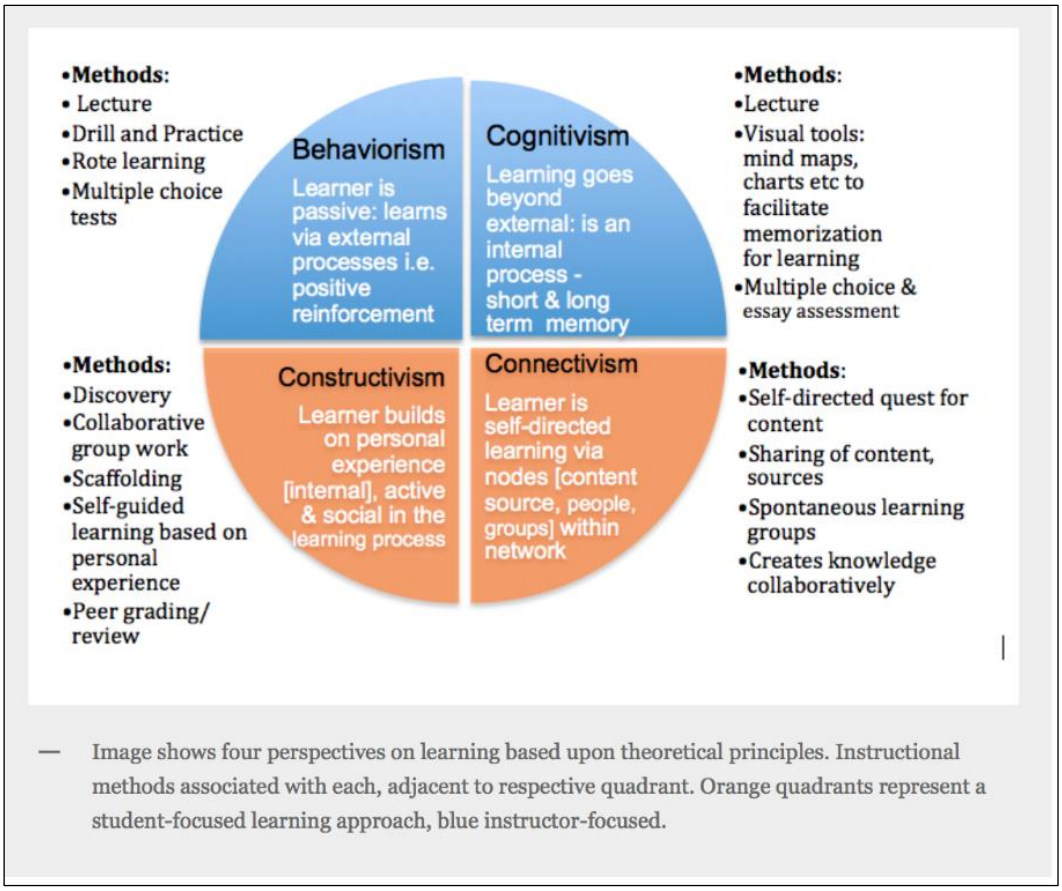
Social media thus offer opportunities for students to benefit from their wider learning community in a way that fits with their lifestyle and commitments. Making use of email discussion lists, online forums or discussion groups "can provide a flexible approach that replicates aspects of social interactions that are valued, though not necessarily achieved, in traditional education" (Gordon, 2014: 14). Such technologies allow for group activities which support collaboration and extend the range of learning opportunities beyond the classroom and even the campus and can be particularly effective for part-time or distance learning.

This is not to say that the sue of social media is not problematic and there are multitudinous examples of such technologies being used both well and inappropriately in educational organisations and settings. The research undertaken in higher education by Lupton (2014: 3), for example, demonstrates a number of benefits for academic staff including "connecting and establishing networks […] promoting openness and sharing of information, publicising and development of research and giving and receiving support. At the same time, however, her research illustrated that the use of social media in HE carries with it risks and ethical issues relation to issues of privacy and the blurring of boundaries between personal and professional use and the risk of jeopardising personal academic careers through "injudicious use of social media, lack of credibility, the quality of the content they posted, time pressures, social media use becoming an obligation, becoming a target of attack, too much self-promotion by others, possible plagiarism of their ideas and the commercialisation of content and copyright issues".

Learning in a Digital Age

Traditional modes of learning within educational organisations and settings thus continue to be based on teacher led activity where knowledge transfer is supported by extended activities to embed learning, even though evidentially there is much potential for directed learning and heutagogical approaches in the twenty-first century learning environment. As can be seen from Figure 3 both Behavioural and Cognitive approaches start from the premise of formal presentation (lecture) followed by practice and application which support the consolidation of learning in different ways. In many ways it can be argued that the development of the Internet encourages a social constructivist approach based on discovery, scaffolding, personal experience and collaborative learning.

Such an approach ignores the theory of Connectivism, first offered by Siemens (2004), which defines learning as a continual process which occurs in different settings, including communities of practice, personal networks and work places and allows teachers to shift focus from their textbooks and presentation to the actual student. Knowledge is emphasised by this theory, which stresses the need to help students gather, access, synthesise and publish knowledge in print or in online media. This knowledge is no longer under the control of experts, but has been distributed and is accessible to average students. In connectivist-based learning, the role of the teacher has changed from that of providing material and presenting lectures to one of helping students create, publish and share knowledge using Internet-based technologies.



— Image shows four perspectives on learning based upon theoretical principles. Instructional methods associated with each, adjacent to respective quadrant. Orange quadrants represent a student-focused learning approach, blue instructor-focused.

Figure 3: Learning in a Digital Age

The theory of connectivisim is based on the following principles:

1. Learning is a collection of opinions;
2. The learning process consists of connected information nodes or sources;
3. Learning can be stored in computers and non-human objects;
4. Learning occurs when the student's capacity to comprehend knowledge is greater than what the student knows;
5. Learning should help students understand the decision-making process;
6. The availability of timely, accurate and current knowledge is paramount to the success of the learning program. (Siemens, 2004: 5).

Digital technologies support Connectivist learning theory because they provide tools for distributing the vast knowledge in the Internet to students in the learning environment. Consequently, Connectivism suggests giving the learner the control to explore objectives defined by that learner (Giesbrecht, 2007) whereby active

participation is required by all and matches the aspirations offered by Confucius: "Tell me, and I will forget; show me, and I will remember; involve me, and I will understand."

Based on the above discourse a model was proposed in an earlier work of mine in regard to student learning in the higher education sector to guide learning beyond self-managed independent learning towards collaborative, interdependent learning (Aldhafeeri and Male, 2015 - see Figure 4). There we argued that student learning potential will not only be enhanced by use of digital technologies that are now readily available, but also foresaw the ultimate aim of such education as being the creation of effective learning environments through interdependency, a state often seen as ideal in the world of work where problem solving and creativity are the product of collaboration rather than independent contributions as suggested earlier (Helfand, 2013). Students in such a system would thus be expected to familiarise themselves with the concept or topic of planned learning outcomes and use the time when they meet to explore, discuss and evaluate the ideas in order to encourage cooperation, collaboration and interdependency.

These are values which are highly valued in the workplace where, within a couple of decades, the tools used in most occupations will be replaced by digital ones (Organisation for Economic Cooperation and Development, 2015) and in situations where it is essential that “young people can demonstrate that they not only possess knowledge demanded by employers, but that they can *apply* that knowledge in different and unfamiliar circumstances” (Mann and Huddleston, 2015: 7: original emphasis).

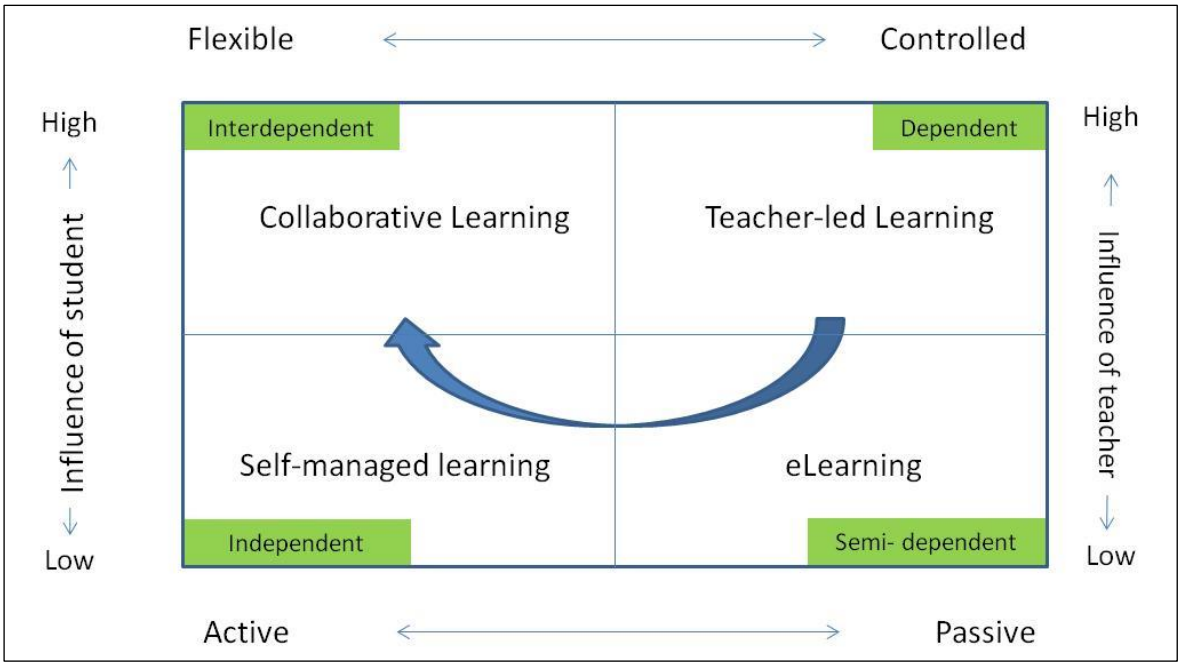


Figure 4 - Learning in a Digital Age
© Aldhafeeri and Male (2012)

Implications for teachers

Regardless of the digital interface employed by students, however, a multitude of opportunities exist within the learning environment for teachers that extend beyond more effective use of readily available software, and in particular presentations based on PowerPoint or Prezi, and include *networking, collaborative learning and problem-solving*, *flipped learning* and the use of *learning analytics* to personalise learning and assessment.

The interactivity of digital devices with Internet access thus provides the opportunity to change the way teachers work with their students and encourage *networking, collaborative learning and problem-solving*. Examples of such behaviours are typically to be found in the less formal environment of social media (e.g. the concept of crowdsourcing), but can be adapted to more formal learning situations. The implication for education organisations and settings are that:

> Social media enables two way dialogues between students, prospective students, educators, and the institution that are less formal than with other media. As social networks continue to flourish, educators are using them as professional communities of practice, as learning communities, and as a platform to share interesting stories about topics students are studying in class. (Johnson et al, 2014: 8)

The concept of *flipped learning* is a strategy that reverses the traditional arrangement by delivering content outside of the immediacy of the face-to-face learning environment and moves higher level cognitive activities into the classroom. In a model of flipped learning, students may watch online lectures, collaborate in online discussions, or carry out research at home in order to engage in concepts in the classroom. Thus instead of the teacher being the source of information they become the facilitator of learning.

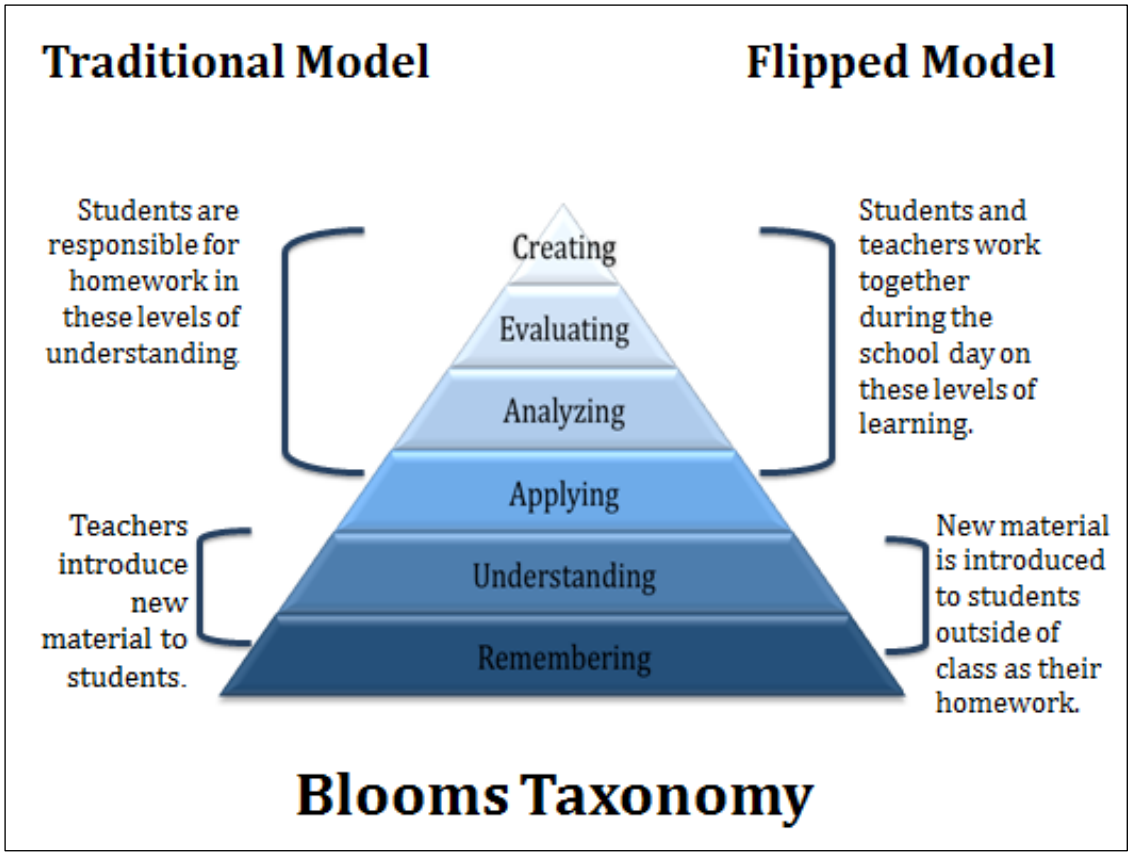


Figure 5: The Flipped Classroom

Learning analytics can be used to personalise both the learning experience and assessment processes. Students (and staff) typically generate a range of data which can be available to analyse for personal trends in much the same way as the commercial world tracks use of online services in order to be responsive and proactive to consumer needs. This emerging science is discovering ways in which to identify individual learning challenges, to personalise the learning experience of students and enable adaptive pedagogies and practice in order to enhance outcomes. Analytics, it is suggested, can encourage students to reflect on how they are learning, or to initiate a conversation between a tutor and a student, instead of merely using the system to assess the student's performance or ability (Higher Education Commission, 2016: 5). Using the data makes it possible, therefore, to not only track student engagement with learning and assessment tasks, but also to provide the possibility for intervention and adaptation of such activities where student progress is not as advanced as anticipated. Key features of data driven learning and assessment suggests Gordon (2014) are the potential to match the mode and learning style of students and to provide support for synchronous and asynchronous activities.

Such opportunities provide the student with choice in how, when and where to access learning materials by offering a suitable range: in other words: *flexible learning*. Equally the learning process can be managed through personalised assessment processes that recognise individual stages of development. Intelligent systems use information "to provide individual learners with material tailored to their needs in terms of content, learning style and potentially other facets of flexibility" (Gordon, 2014: 10). This leads him to conclude that, for universities, there are three possible approaches for universities to adopt in the new era.

1. To enhance traditional lecture courses through stand-alone online material;
2. Deliver material electronically with a restricted requirement for real-time (and possibly on site) interaction;
3. Adopt a wholly distance learning approach.

Even the first element suggested here moves the learning experience beyond the immediacy of the face to face interaction and supplements provision that is reliant on a teacher, however skilled they may be in making real time use of presentation software and online materials. By making use of flexible learning opportunities educational organisations and settings can enrich the learning opportunities for their students.

Further opportunities also present themselves through wholly online provision, and especially Massive Online Open Courses (MOOCs), particularly for universities. It is important to recognise, however, that whilst students are comfortable seeing the digital space as valid contact in their social lives, at university they still generally expect course content to be delivered in classrooms and lecture theatres and tutors to provide face-to-face support (Higher Education Commission, 2016: 50). In other words, students still expect their teacher to be instrumental in leading their learning. If education continues on the journey of partnership between teacher and learner, however, then there needs to be "a culture shift where both students and tutors are comfortable with having more of their learning take place in virtual and simulated environments and having tutor support provided through electronic means (or even through analytics systems themselves)" (Higher Education Commission, 2016: 50).

The main implication for teachers intending to taking appropriate action to extend learning opportunities in the current (and future) era is thus for an adjustment to the

strategy of using digital technologies to extend behavioural and cognitive approaches towards constructivist and connectivist learning. Here the work of Puentedura (2010) is of direct relevance with the *Substitution-Augmentation-Modification-Redefinition* (SAMR) model. Although others have also worked in this field of recognising the potential of technology to not only enhance, but also to transform learning (see McCormick and Scrimshaw, 2001, for example), it is the SAMR model that provides the most effective explanation. As can be seen from Figure 6 the teacher who uses technologies merely to enhance presentation, for example, is substituting that medium without changing their basic strategy. Even with use of tools with greater capability, such as interactive websites, the teacher is till only augmenting the regime of teacher led learning and remains in the enhancement stage recognised by both Puentedura and McCormick and Scrimshaw.

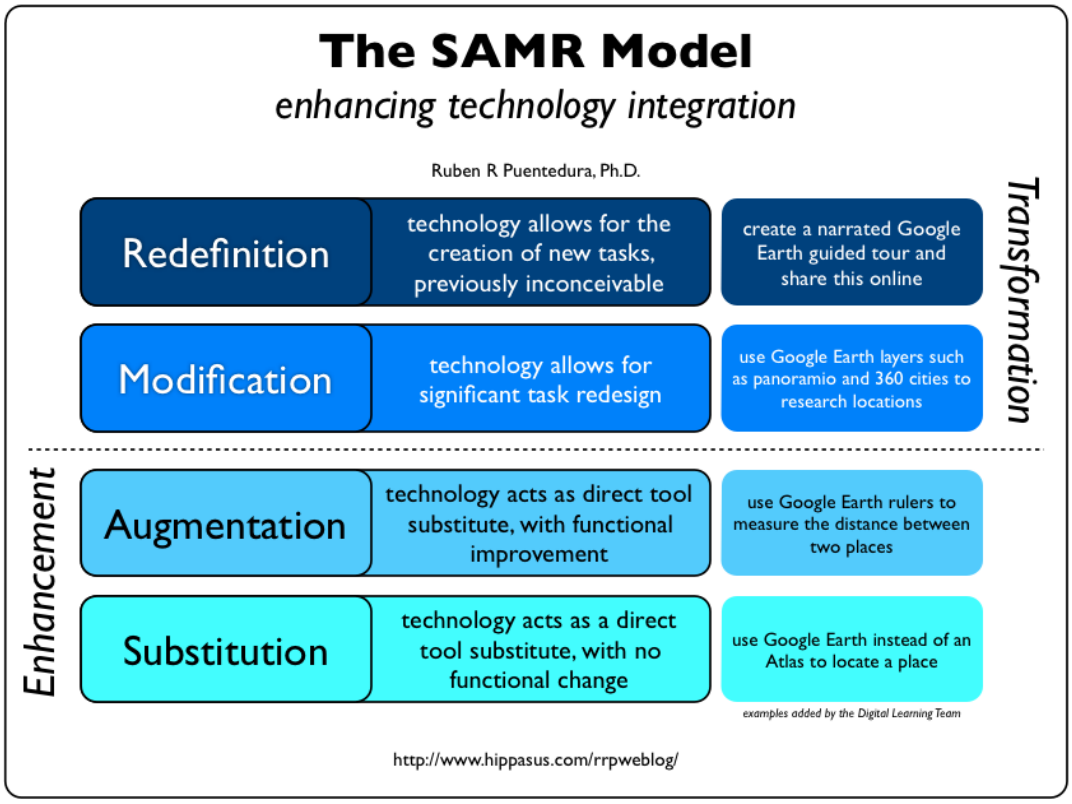


Figure 6 – the SAMR Model (Puentedura, 2010)

It is only when teachers look for significant changes in the task, such as the flipped classroom, or the learning outcomes, that they move into the transformation stage of the model where modification and redefinition come to the forefront of their planning and delivery of the student learning experience. In order for this to happen, however, there needs to be a transformation in teacher expectation and capability.

Changing teacher behaviour and capability

Sadly, however, we have seen and continue to witness that teachers remain fairly conservative in their style and willingness to change and cause most delay to the use of technologies to transform learning (Aldhafeeri and Male, 2015). The research that informed this finding was carried out in a country with a high level of personal wealth and showed academic staff and students to be extremely well equipped with personal mobile digital devices and generally considering themselves to be competent users of such equipment and associated software applications. This now seems to be the most common scenario as we move further into the current century, with similar findings reflected in other cross-country contemporary studies (e.g. Palaiologou, 2016). Nevertheless, teachers typically express a view that "integrating new technologies might be felt to diminish classroom control or make it more difficult for staff to assert their authority" (Gilbert, 2015: 52).

The key elements for successful use of digital technologies in the twenty-first century are the teachers, leaders and other decision makers who have "the vision, and the ability, to make the connection between students, computers and learning" (Organisation for Economic Cooperation and Development, 2016: 191), with the 'holy trinity' of the student vision for educational experience being:

- learning that is socially-based and collaborative;

- learning that is untethered from the traditional constraints or limitations of education institutions; and
- learning that is digitally rich in context and relevancy. (SpeakUp, 2014:15)

Exposure to personal digital equipment is a first step in this process of transformation, followed by a willingness to collaborate and share ideas, resources and practices. Fundamental to this transformation process is the recognition that teaching is not just about content knowledge, but was also about pedagogical and technological understanding and capability in this digital age. This combination of knowledge and skills is demonstrated in the TPACK model (Koehler and Mishra, 2009 – see Figure 7). As can be seen, the effective teacher in a digital age is one who has Technological, Pedagogical and Content Knowledge and Skills.

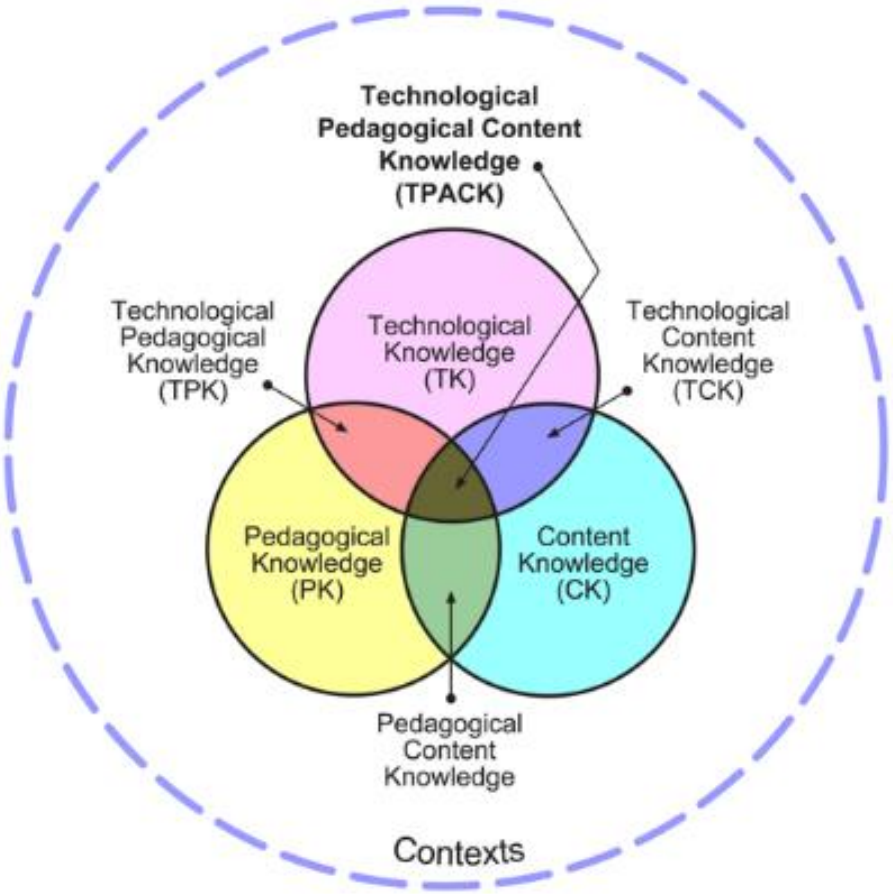


Figure 7 – The TPACK Model (Koehler and Mishra, 2009)

Conclusion

The conclusion to be reached is that there is still ineffective use of available digital technologies in educational organisations and settings which seems to be more to do with attitude rather than lack of opportunities and skills. In this century, however, this not a satisfactory reason for failing to take advantage of the capability to utilise the potential of digital technologies and personal mobile devices with Internet access. It seems, therefore, the current situation that permeates all phases of education globally in that the technology exists, as does the capability to use it, but the willingness to exploit it is limited. The source of such limitation is typically based around intransigence of teaching staff to adapt their practice, a response often disguised through concerns about student safety and the validity of data sources when using the Internet. It is time to move on.

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