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Learning in the age of digital networks.

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Introduction

The final years of the twentieth century and early years of the twenty first century have been marked by the rapid rise of digital and networked technologies. Some have even called it a paradigm shift and suggested that it will lead to a dramatic change in the way young people learn (Tapscott and Williams 2010). As with all commentary on new technologies we should beware of being carried away with the excitement of the new. There is a recurrent innovation cycle beginning with over excitement followed by disappointment and once the reaction has set in against the new it is followed a move away to yet another new technology, often before a proper assessment and evaluation of the previous cycle can take place. Equally we must be careful not to ignore the profound changes that are taking place and how they may affect universities and learning in society more generally.

A recent description by a UK based think tank *Demos* characterized the kind of university that is emerging from the engagement with new digital and networked technologies as the 'edgeless university' (Bradwell 2009). The term edgeless is borrowed from work on the city that suggests edgeless cities have the function of cities without being organized in their classic form. In the same way the *Demos* pamphlet suggests that the university retains an identifiable function but the functions of the university are no longer confined to a single institution nor are they confined to higher education institutions more broadly. Over a decade ago Brown and Duguid (2000) identified the core functions of universities as the capacity to grant degrees, to accredit students and to provide the warrant that guaranteed the credentials obtained by the students from the university. They also suggested that the introduction of what were then new technologies would lead to an increased focus on these core functions. The core role remains in the edgeless university but the boundaries to these may alter.

This article tries to provide a way of thinking about new technologies that manages to balance these two conflicting needs. It identifies some current ways of thinking about the changes taking place in universities that are related to digital and networked technologies and to assess their impact. It then goes on to suggest the kinds of choices we may have to make in relation to new technologies at a variety of levels, the personal, the institutional and in terms of society in general. The edgeless university is associated with broad technological change but whether such change is inevitable is still an issue that needs to be discussed.

The impacts of new technologies

It can be seductive to follow all the latest changes in terms of new technologies. Today the i-Pad takes the attention of many commentators, at other times recently it has been social networking sites such as Facebook or micro-blogging sites like

Twitter. More generally commentators have focused on general changes in media and the technological forms, concentrating on the new social media and Web 2.0. It is certainly important to keep up-to-date with technological changes and there are significant shifts in the technological and media landscapes, however it is important not to be seduced by the latest craze or the most fashionable development. In general terms the new digital and networked technologies have led to broad changes that affect education. Jones and Dirkinck-Holmfeld (2009) capture these changes in the following list:

- **Time shifts** – Computer networks used in education affect the usual time patterns of education. Many courses delivered across networks are asynchronous.
- **Place** – The introduction of mobile and ubiquitous computing devices have begun to make the idea of education occurring at anytime, anyplace, and anywhere seem more feasible.
- **Digital preservation** – The outputs of synchronous and asynchronous activity are easily preserved in transcripts, logs and a variety of other forms including the archiving of web casts and audio interviews/podcasts.
- **Public/Private boundaries** – The preservation of what would otherwise be ephemeral materials alters the boundaries between what is public and what is private. Tutors can now view and preserve the details of student's interactions during group activities, making these available as tools for assessment.
- **Forms of literacy** – The still largely text based world of networked learning has generated new forms of writing that are neither simple text replications of informal conversation nor are they formal written texts. The integration of images and audio into digital environments has suggested new forms of multimedia literacy.
- **Content** – The boundary between content and process is shifting. Blogs and wikis can provide elements of content and cut and paste re-use is common practice. The idea that there is a clear distinction between activity/process and artefact/ content is becoming strained. (Jones and Dirkinck-Holmfeld 2009 p10)

This is, of course, not an exhaustive list and many others could be developed to capture the changes taking place. The significance of the list is the way it moves away from a consideration of any particular tool or technological advance to consider the general issues that arise from the application of new technologies on a broad scale. This is important for education because although there is very rapid change there is also continuity and educational processes are not quickly changed because they are embedded in historic processes and national and state driven policy agendas that move at a considerably slower pace of change.

Within this short article it is not possible to deal with all the issues raised by the technological changes taking place but we can deal with a small number of examples related to the theme of contemporary change and the edgeless university. These are:

1. The claims made in the Net Generation and Digital Natives arguments about how technology is affecting new millenium learners,

2. The emerging tension between centralized institutional learning management systems (called Virtual Learning Environments in the UK) and more personal environments enabled by new technologies,
3. The impact of cloud computing on core services provided by educational institutions for learners

Each of these issues is presented firstly in terms of the effects of the new technologies on education and then each is explored in terms of the choices that these technological changes allow for at various levels in education.

New millennium learners

By the time that students in advanced industrial countries arrive at university they are already familiar with a variety of computing devices and the use of digital networks and they have developed practices that have relevance for teaching and learning. The availability of digital networks and a wide range of devices, including laptop computers, mobile devices etc, connecting to these networks means that the world that many young people grow up in is defined by new technology. A literature has become highly influential that argues that this new technological environment is having profound, identifiable and universal impacts on young people. Two of the most common ways used to describe the new generation of young people are the Net Generation (Tapscott 1998, 2008) and Digital Natives (Prensky 2001, 2001a), although a number of other terms are also used, including Millennials and Generation Y. These authors argue that there are distinct generational boundaries and that young people have:

.. not just changed *incrementally* from those of the past, nor simply changed their slang, clothes, body adornments, or styles, as has happened between generations previously. A really big *discontinuity* has taken place. One might even call it a “singularity” – an event which changes things so fundamentally that there is absolutely no going back. (Prensky 2001 p 1)

In response to the impact of these terms there is a growing literature that is critical of the Net Generation and Digital Native arguments. Some of this literature is based on empirical research (Bullen et al. 2009, Jones et al. 2010, Kennedy et al. 2008, Pedró 2009, Selwyn 2008). Other critics have taken a more theoretical stance (Bennett et al. 2008) suggesting that the Digital Native argument is a form of moral panic that has had the effect of closing off debate. The empirical research demonstrates that students in advanced industrial countries are far from homogenous in their response to new technologies (see Kennedy et al. 2008 and Jones et al. 2010). In particular it shows that the Net Generation age group is itself divided by age internally (Jones et al 2010) and that age related differences occur across all ages and show no signs of the kind of generationally organized digital divide that is suggested by the literature (Prensky 2001).

The generational arguments arising from the writings of Tapscott (1998, 2008) and Prensky (2001, 2001a) amongst others, suggests that a whole generation of students has been affected by their immersion since birth in a world infused with digital and networked technologies. It is suggested that this technological immersion is a line of causation, with the technological changes causing a change in the relationship of a cohort of young people to the technologies themselves and a range of other activities

including learning. For example the Net Generation has been associated with a tendency towards collaboration and Tapscott's has suggested that:

In education they [the Net generation] are forcing a change in the model of pedagogy, from a teacher-focused approach based on instruction to a student-focused model based on collaboration. (2008 p 11).

The empirical research describing students at university suggests another reading of the situation in which the developments in digital and networked technologies allow for, or afford different patterns of engagement with technology and learning but they do not force any particular change. Technologies in this reading do not force change, rather they define the range of choices that can be made. Students for example suggest that the new technologies can be distracting when they are working. Agent driven notifications appear on screen while the students work with multiple applications open at the same time with some providing educational and work related support whilst others are related to the student's social life and leisure. Students are not passive in response to this tendency to distraction and indeed they actively choose to follow their own strategies for dealing with this technology driven phenomena (Jones and Healing forthcoming). Choice is not only concerned with the individual student and their relationship with technology and universities are also making choices as the next section argues.

Centralisation and decentralization

Many universities now have a provision of centralized and integrated tools for teaching and learning. In many ways this is a sign of success, because technology enhanced learning has moved from the margins of university life into the mainstream. Weller (2010 p) has identified the following advantages to such centralized systems:

1. Uniformity of student experience
2. Centralised support
3. Quality assurance
4. Efficiency
5. Robustness
6. Integration of different tools
7. Staff development
8. Platform for expanding elearning offerings

However the integration of what are known as Virtual Learning Environments (VLE) in the UK and Learning Management Systems (LMS) elsewhere has occurred alongside the development of a range of technologies that have been captured using the term Web 2.0 (Sclater 2008a). Web 2.0 environments seem to offer greater choice and the possibility of personalization in learning and Web 2.0 provides a contrast to the institutional and centralized approach embedded in the VLE/LMS systems provided by most universities. Sclater has noted that other educational technologists, such as Martin Weller, have argued that the VLE/LMS as a large application is unsustainable and that future provision of services by universities is likely to be via a range of components built by different companies or projects which interact with each other over the Internet (or an intranet) via web services in the form of a distributed learning environment (Sclater 2008 p9).

The various VLE/LMS platforms, such as Blackboard, Moodle, Sakai and WebCT have been challenged by educational technologists who suggest that a more decentralized, personal and loosely coupled learning environment would be more appropriate for use in higher education institutions (Weller 2010). The reasons given for more personalized and loosely coupled systems were summarized by Weller as:

1. Quality: The individual components of an integrated system will not be as good as specialist tools performing any one of these functions
2. Flexibility
3. Pedagogic suitability
4. Relevance
5. Educator control
6. Personalisation

Weller's article has usefully summarized the choices that arise between the VLE/LMS and more personalized systems in terms of a spectrum spanning centralization and decentralization. Although Weller has been an advocate of decentralized and personalized systems he concludes that the fully individualized PLE may not be possible or desirable in higher education. However he also argues that maintaining separate, often inferior versions of commonly available software is also not a sustainable position (Weller 2010). The central issue that Weller identifies as placing a restriction on the fuller development of personalization and decentralization is the need for control. It is several years since Brown and Duguid (2000 Ch 8) identified the core functions of universities as degree granting, suggesting that universities might be reduced towards their core and become 'Degree Granting Bodies'. It is because universities need to maintain this core function (by providing credentials, such as degrees and certificates, and standing behind these awards by warranting the procedures) that control is maintained in the center to ensure the quality and standards represented in the university's credentials. The choice involves technological change and it is constrained by these changes but it is also a political and institutional choice related to the core social function of the university.

Into the clouds

The institutional choice between centralization and decentralization is being affected by another development, the possibility of what is called cloud computing. The term cloud computing has various definitions and having reviewed over 20 alternatives Vaquero et al. (2009) proposed the following:

Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically re-configured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized SLAs. (p. 51)

There are potentially significant cost advantages to such an arrangement and a range of options from simple data storage to client –server arrangements where the application is also stored and maintained by the cloud supplier (Sclater 2010). Apart from cost advantages for educational institutions in signing up for cloud services, such as Apps for Education or Live@edu, these services can also allow for spikes in usage,

such as when exam results are released, and an apparent infinite scalability. A cloud service that has gradually been taken up in education is Second Life, because few educational providers would ever consider hosting the service, leaving provision to Linden Labs. Currently one of the services missing from existing cloud services such as Google Apps is assessment even though Google Apps integrates with software such as Moodle, enabling a single sign on, and Moodle itself is already hosted in the cloud.

There are many serious issues for universities that arise with the use of cloud computing and these include considerations about where the cloud is physically located. The 'Googlisation' of university services may lead to a backlash if Google becomes too closely associated with the university (Sclater 2010 p 15). There are also legitimate concerns about the storage of sensitive staff and student data, particularly if it is located off-shore, for example in the USA, where data protection laws are less strict than in the EU. Currently Google claims that European student data will be held in compliance with EU law, and generally companies have privacy policies which restrict or prohibit data sharing with third parties and data mining of individuals' information, but this may not be enough for universities to take such a significant step. Furthermore large corporate suppliers of cloud services are not immune from service disruptions and a single cloud supplier is potentially a single point of failure, even if the data centers themselves are distributed (Sclater 2010 p15). Importantly there are still accessibility issues for disabled users, demonstrated by recent tests at the OU particularly with regard to screen readers, and both Google and Microsoft systems do not function equally well on all browsers (Sclater 2010 p16). There are also lingering usability issues such as the ability to drag a document from the desktop to a Web browser window, though this may be addressed in future versions of HTML.

Cloud computing offers businesses a number of significant advantages in terms of cost, dealing with uneven demand and the potential for scalability. However for universities the technical availability of cloud computing has to be balanced against the organizational needs of the university in providing services to all potential students regardless of variations in ability and the need to provide secure data storage that respects staff and student requirements for confidentiality. These university requirements are not necessarily at the forefront of the issues designers confront when developing commercial services and universities have a number of significant choices to make if they wish to make use of the commercial benefits of cloud computing.

Choice and the affordances of new technologies

A key feature of the three debates that we have introduced is the issue of choice. Technologies do not determine outcomes, though they do condition the parameters within which choices can be made. The arguments presented as part of the Net Generation and Digital Natives debates have suggested that a cohort of young people entering university is distinct from previous generations and that their characteristics are derived from their exposure to new technology. We have argued that this is not borne out by empirical research which shows that whilst age is a significant factor in relation to the use of technology there is no single Net Generation composed of Digital Natives, nor is there a sharp divide between this group of young people and those who are older. Indeed the Net Generation age group is divided internally by age and the kinds of age related differences that we find are dependant on the specific technologies being investigated, with the newer technologies showing the sharpest age

related differences. Technologies do not seem to determine student approaches to the use of technology, rather young people seem to be actively engaged in the process, making choices about what technologies to use, in what ways and how often. Equally choices are not simply made by individual students they are made by institutions who determine the kinds of infrastructures for learning, such the local VLE/LMS that students engage with.

The current developments in terms of Web 2.0 technologies have generated a debate about the use of institutional VLEs/LMSs and the potential to provide a more personalized and decentralized system, sometimes referred to as a Personalized Learning Environment (PLE). We have argued that the choice is not one that is either simply determined by the technologies or narrowly focused on technological issues. Instead the choices we identified are ones that affects the core functions of the university and a key restriction on the full development of the technical possibilities of personalization is the institutional requirement that universities have to retain a degree of centralized control to ensure the quality of the credentials they issue to students. Finally we examined the current trend towards cloud computing and how the storing and sharing of data entailed with this development could conflict with university requirements. Cloud computing also has implications for accessibility and the need for universities to allow access to students with a range of disabilities. The issue of cloud computing like the discussion of more personalized systems for learning touches on core aspects of a universities mission. Choice in these circumstances involves consideration of technological issues and the technologies can in some ways define the parameters for the range of alternatives, however choice remains a highly political question, touching as it does on the central role of the university in society.

The edgeless university?

We began this article with a reference to the idea of the edgeless university. The idea of the edgeless university suggests the university has retained an identifiable function in the new technological landscape but that the role of the university is expanding beyond the single institution and even beyond the confines of higher education institutions as such. Cloud computing is one notable area in which this kind of development is immanent in the most current of technological developments. Cloud computing would place university services outside of the university itself and store data beyond the territorial limits of the state. As we have argued above this development in technology does not lead to inevitable change, rather it leads to challenges and choice. Like all revolutions, the technological revolution that some have claimed technologies independently drive forward, is inevitably political and being a political process it involves someone, an organizational body or individual person, choosing which futures to enable and which to deny. Educators in the early 21st century find themselves at a point in time in which new technologies have expanded our range of choice but they have not relieved us of the necessity to choose.

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