"We will fix the deficit": deficit theories in the literature of educational technology adoption

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Literature that hopes to explain or instruct in the use of educational technologies in universities tends to occur as deficit theories of technology use, implicit in several bodies of literature. This paper addresses the hidden and not so hidden discourses about how to improve use of educational technologies. Five 'instrumental' bodies of work are analysed; the lists and instructions that make up 'cookbooks' of information on how to use educational technology, information literacy literature that stems from librarianship, the novice/ expert theories which underpin some forms of classroom instruction, Prensky's 'digital natives/immigrants' theory, and that group of theories arising from Roger's 'diffusion of innovations model', including the 'technological adoption model' (TAM). I argue that each of them differs in conceptualising user agency, the form that knowledge takes, the nature of social change and the culpability of the user while maintaining an instrumental approach that is ultimately based on techno-utopianism.

Keywords: Deficit theories, educational technology, learning management systems

Introduction

Discourses on academic use of educational technology do what discourses usually do, they shape understanding, including the way that educational technology use is understood. They also shape the research questions normally asked and the answers that people are prepared to accept. Many forms of writing about educational technology purport in some way to cover the transition from being unable or unwilling to use conventional educational technology to adopting it - making it work to some effect. This instrumental discourse confines thought about use of Learning Management Systems (LMSs) and other educational technology to a narrow range of theories of behaviour change, which may be explicit or implicit in the discourse. Argyris and Schon (1974) employing Polyani's concept of tacit knowledge, called such action based theories, "theories in use", to distinguish them from more formal theories. Yet even where the literature is explicit about how changes to technology adoption behaviour might occur, it is still possessed of implicit theories in use about human nature, educability and social change. Most analyses imply deficits in some aspect of technology use. It is these that this paper is intended to open up.

To illustrate how academic adoption is depicted in work that seeks to encourage some 'adoption' or 'use' of educational technology, I have largely confined myself to literature and instructional writing that supports the adoption of LMS's, particularly Blackboard, in academic teaching and learning. This work has a longer history than that associated with adoption of social media as educational technology. I have selected work I think forms and informs the variety of discourses prevalent across the field. Included, therefore, along with journal articles and academic literature, is instructional writing - those drop-down menus and lists of steps found when clicking 'help' buttons as well as similar lists of steps to mastering some specific form of technology issued from time to time by universities to assist adoption. Thus although the subject content might be narrow, the genre, 'assistive writing' is broad.

My main criterion for inclusion of any particular type of assistive writing is whether the primary goal of such literature is instrumental. By 'instrumental' I mean intended to make things work or to be the means of achieving the goal of working with technology. The defining characteristic of such writing is that it is teleological - the means to a functional end, defined by the purposes served rather than by, for instance, seeking phenomenological perspectives on its meaning to the user. It is not about how we feel or experience, nor is it necessarily about careful empirical description of the processes of actual adoption of educational technology, it is about attaining use as an end in itself.

It is a peculiar feature of these instrumental literatures that they appear to consistently entail deficit theories to account for the cause of non (or poor) technology use. Heidegger (1977) is helpful here. He defines 'cause' as "being responsible for something else" (p 7). Heidegger himself is fully aware of the ambiguity that the idea of 'cause' especially when read as 'responsible for' can harbour. He points out that it can be understood either as a (moralistic) 'lapse', or it can be understood as 'effecting' (in the sense of a factor effecting a change) (p 9).

Pursuing these two interpretations beyond Heidegger, both point to possible lacunae in the development of technology use. A moralistic lapse is clearly a matter of a fault in the agency of the user or in some other significant technological agent that results in a gap in execution of desirable ends. By contrast, a fault in 'effecting' is morally neutral, but a matter still of a gap to be located and remedied in the manner of how to effect technology use. One can make things work or be the means of achieving the goal of 'working' either passively as does a tooth in a cog, or a windmill in response to wind - to use Heidegger's analogy (p 14) - or actively, as does a craftsman. Both types of causal attribution are evident in the writing on educational technology use. But given that instrumental writing, from sets of instructions to analytic literature are aimed at making things work, the consequences of allocating the cause of the deficit to one side or the other are great.

Major orientations

Three orientations to adoption of online education technology show up in writing on the matter of instrumental adoption of educational technology; a teacher or pedagogy focus, an organisational focus, and a technological focus (e.g., Conole, 2007; Hannon, 2008; Reid, 2012). Dahlberg, (2004) basing his distinctions on the wider field of internet studies makes much the same separation, calling the divisions, "uses, artifacts and social contexts"(para.2). These three orientations constitute macro level frames for informing discourses about what is going on. Teacher or user focused solutions to adoption take some aspect of the person adopting the technology to be the primary factor in successful use. Technologically focussed solutions take amending some part of design or its implementation to be the operative features of adoption, and organisationally focussed literature understands organisational transformation to be either a cause or an outcome of the successful introduction of technology.

The mere fact of such disparate perspectives can led to problems. Proponents of these three orientations tend to misunderstand each other, mismatch goals (Hannon, 2008, p. 389), ignore each other's existence, or in the case of the organisational focus, understand all three to be legitimate sites of manipulation. However these three loci of enquiry also propose alternative problem sites. The problem orientation in each is to represent non use as a deficit in something different; in teachers, absence of computer skill or insufficient knowledge of correct teaching method; in technology, badly designed software or in organisations, insufficient management.

Given the size and extent of the literature tracing each of these three perspectives, in this paper I concentrate on the orientation that focuses on the user. My second criterion for inclusion therefore is that the writing intended to assist with educational technology use, or the body of literature analysing patterns of use, be that which implicitly or explicitly focuses on changing the user directly. Literature which suggests that the main focus of changed use stems from something about the technological or organisational context 'driving' that use is also excluded. I intend to address this latter in a future paper. A further final paper will canvass the possibilities for alternative perspectives that are not implicitly deficit approaches, and which may move forward a change in problem framing and the orientation in research identifying and explaining patterns and perspectives on educational technology use.

The user orientation

From its simplest manifestation, providing lists of instructions to fill gaps in computer operating information, to more complex attempts to address shortfalls in pedagogical philosophy, user focussed problematisation also leans towards user focused deficit identification. Ordering these along a continuum of causation and agency from simplicity to complexity, types of deficit that appear in the educational technology literature include skill or ability deficits, information deficits, learning deficits, developmental deficits, cultural and accumulated environmental deficits and lastly, character deficits. These categories can overlap especially with their near neighbours in the literature, however they can be illustrated via separating out the following bodies of literature which have as their purpose, facilitating technology use, and which have been used in some form to advance the adoption of educational technology.

Cookbooks or Lists

'Cookbooky' instructions on how to teach with technology describe technological interaction algorithmically, manifested in guides and lists of instructions that are short, symbolic or generic sets of instructions. These instructions are recipe like and incorporate an idealised work flow portrayed as a sequence of changes which are more or less linear, although some paths may be simultaneously pursued. The term "cookbooky" comes from Herbert Simon's description of "the sciences of the artificial" (Simon, 1996, p. 112). This sort of instruction assumes that all that is necessary to master technology use is information, usually arranged as a sequence of

activity ‘steps’. Some examples are relatively simplistic and prescriptive (CQU Academic Staff Development, 2010; Khan, 2005; R. Oliver & Herrington, 2001) . The CQU Teletutorial Guide (2010) succinctly demonstrates the instrumentality of the knowledge to be conveyed,

> This Teletutorial Guide seeks to explain what should be done to prepare and deliver a teletutorial, when things need to be done, and who should do them. (p. 4).

"Cookbooky" instructions often take the form of some kind of list. Lists are frequently to be found on university websites, giving instruction on how to use on-line tools and on the attendant policy pertaining to its use (McIntyre & Bennet, 2010). Much of it is oriented to "how to..." without "why to..." and is contextless in that information is typically about a step to add or correct an LMS entry, but does not describe its part in a process or point out the rationale for it. The Melbourne University ‘Introduction to the LMS’ for instance is a purely technical set of instructions - how to navigate around the LMS and its portal website. It almost completely avoids reference to teaching (University of Melbourne - unimelblms, 2012).

In many of these guidebooks where instruction takes a less virtual form, the varieties of technology are the whole of the focus (Bates & Poole, 2003; Dunn, Wilson, & Freeman, 2011; Manning & Johnson, 2011). However there are also LMS specific guides, such as Southworth et al (2011) which is set up in the ‘for dummies’ format like a recipe book. Sometimes the guide can be to one specific use of a single LMS, Blackboard, e.g., to carry out assessment of laboratory skills (Epping, 2010). On occasion, the guide can be almost totally isomorphic with the technology, the structure of the course ‘skills’ replicating the generic layout of Blackboard's information architecture (Leo, 2011). Other guides are quite sophisticated and complex but still qualify as ‘cookbooky’ by virtue of concentration on technique. This technique can be that of learning the various technical genres of the technology (Clark & Mayer, 2011; Gosper, 2008; Iskander, 2008; Okada & Connolly, 2008), or it can be devoted to the learning of appropriate personal techniques for interaction (Anderson, 2004; Rudestam & Schoenholtz-Read, 2010).

The point of an algorithm or a recipe is to achieve the execution of a task, an almost exact definition of instrumentalism. However their very construction as contextless chunks of technique may militate against their producing any clarity in the mind of the user. They are based not on a workflow integrated with the purpose of use, but on an assumption, as Weick (1995, pp. 97–99) understands it, that the problem is a problem of ignorance stemming from insufficient information, and that more carefully organised and hierarchically presented information will solve it. Cookbooky formulations of how to teach online are little tools which develop and encode the ways in which new academic practice is to be understood. They mirror the layout of Learning Management Systems in setting out ‘steps’ and they replicate and confirm that this is a correct or at least an explicable arrangement. They act as a template for practice which reduces choice and simplifies a multitude of possible approaches down to an acceptable one.

Nevertheless they postulate a deficit in technical skill, technique or information or all three. They treat knowledge as uncomplicated ‘information’, delivered as an object or product to fill the gap; the user ‘agent’ is absent from discussion but apparently willing to address the deficit; and the theory of change inherent in lists and cookbooks is that adoption occurs when they do so.

Information Literacy

Information literacy grew out of library science but was soon widened to cover all aspects of use of information and communication technologies. It includes concepts such as computer literacy and technological literacy in general. It is distinct from the autodidactic expectations of the aforementioned cookbooks and lists, because it adds a formalised concept of education to information finding about using technology. Information literacy can be thought of as adding both targeted instruction and concepts of competence to users understanding of technology use. Nevertheless it still constructs the problem of technology mastery as a gap or deficit in sometimes a broad range of skills, but also in technological ‘competence’.

Information literacy proponents have articulated grand ambitions, understanding the acquisition of good technological skills and sound management of information as revolutionising society (see e.g., Information Literacy Meeting of Experts, 2003). It has also developed an extraordinarily large literature. A July 2014 search of the Science Direct database returned 38,435 results for the term ‘Information literacy’. Rader (2002) in a literature review spanning 1973 to 2002, found more than 5000 publications related to library user instruction and information literacy, and Aharony (2010) collected 1,970 publications researching information literacy between 1999 - 2009 from the Web Of Science database alone. Furthermore Rader (2002, p. 242) estimates that

around 60% of publications on Information Literacy for that time period, pertain to higher education.

It is curious therefore, given the size and ambition of this body of literature, that more work has not been devoted to assessing and meeting the information literacy needs of academics using LMSs or other educational technology in higher education. This may be largely due to an overwhelming conflation of students with users, a perspective that positions academics, if they are considered at all, as co-educators of students with librarians (see e.g., Asher, 2003; Corrall, 2008, p. 28; Ferran & Virkus, 2011, p. 80; Ivey, 2003; Johnston & Webber, 2003, pp. 342–343; Rader, 2002, p. 243). Sproles, Detmering & Johnson (2013) note in their literature review that collaboration and partnerships are a dominant theme and of these, most articles discuss partnerships between faculty or teachers, and librarians (p.408). However LMSs do appear. There is some work which looks at Blackboard as a means of educating students in information literacy (Farmer, 2003; Jackson, 2007) and some that does the same for WebCT (Hightower, Rawl, & Schutt, 2007; Kraemer, 2003) in the much larger Information Literacy literature devoted to educating students about information technology literacy.

Nevertheless, academics in higher education attend training sessions and other educational occasions in order to understand how to use LMSs and other educational technologies. The majority of these sessions are one off and address basic manipulation of the course management system (Meyer & Murrell, 2014). Although the literature is silent on the matter, it is possible to suggest that trainers are informed or influenced by the tenets of information literacy given that cross disciplinary interaction between academics and librarians in teaching students information literacy competencies also acts as a vector for academics' approach to educational technology. Certainly some academics are exhibiting high degrees of digital literacy and changed knowledge practice in their use of educational technology across many of the criteria defined by digital literacy standards. Paying attention to how this form of knowing about technology use is formally constructed can help to clarify its orientational underpinnings.

Unsurprisingly, given the sheer size of the literature, information literacy (IL) is a diffuse perspective largely held together by its focus on practical outcomes. As Tuominen (2005) says, "Many, or most, texts on IL consist of normative prescriptions of information skills needed in modern society" (p. 330). Such prescriptions are to be found in information literacy publications which describe models and standards for IL (Bawden & Robinson, 2002; Doyle, 1994; Johnston & Webber, 2003, p. 341 ; Rader, 2005). These standards are generally formulated as lists, but more recent work has included multidimensional rubrics (Reedy & Goodfellow, 2013). The SCONUL "Seven Pillars" model which was first developed in 1999, and substantially updated in 2011, has always had some features of a rubric that have over time been refined (SCONUL Advisory Committee on Information Literacy, 1999; SCONUL Working Group on Information Literacy, 2011b). The updated model includes special sub- models for digital literacy (SCONUL Working Group on Information Literacy, 2012) and for open education resources (SCONUL Working Group on Information Literacy, 2011a). The use of rubrics reflect the field's educational aspirations focussed around a staged or developmental idea of educational acquisition.

While it must be acknowledged that the Information literacy approach makes some valiant efforts to move beyond the instrumental, it can still be practised in an instrumental manner. Johnston and Webber (2003) note a friction between "a surface learning approach (simply memorising and reproducing the content as presented with limited attention to application or transformation to new contexts), rather than a deep approach (in which the student intends to make sense of the content and develop a personal understanding)" (p 342). This observation appears to reflect the difference between the aspirations of the field, and the exigencies of practical delivery. At its most instrumental, Information Literacy defines a set of competencies that learners must achieve (Ferran & Virkus, 2011, p. 72; Pinto, Cordón, & Díaz, 2010, p. 4), competencies that have been criticised as consisting of "tick the box" approaches delivered as "one shot" training sessions (Johnston & Webber, 2003, p. 342). Information literacy has also been accused of leaving out the technological context as well as the social and cultural context of computer use and task mastery (Lloyd & Williamson, 2008; Poll, 2011; Tuominen et al., 2005). Such practice rests on a deficit conceptualisation of 'use'.

Critics label its conceptualisation as objectified 'information processing' (Marcum, 2002; Pawley, 2003, p. 425) associated with initial development of technological communication as information processing "which established the fundamentals of signals, bits, measurement of information, and the role of entropy in the information process" (Marcum 2002, p 3). In this respect Information Literacy can draw on a similar conceptualisation of knowledge as the cookbook approach; it is object-like and can be transferred, unmodified by the means of transference.

Little is said about the agency of the user. Users are assumed to be more or less undifferentiated in their range

of technical or information management ability or in their motivation for mastery of competencies. In both 'cookbooks' and the information literacy approach, the problem is understood as intrinsic to the individual user, but the attribution of cause is extrinsic. An absence of information literacy is (tacitly) attributed to a lack of opportunity or to incorrect conditions for acquiring information. There are a few exceptions such as Pinto et al., (2010) who include user motivation and self efficacy as well as the users' preferred source of learning as factors in an information literacy approach. A further exception to this appears in the two rubrics mentioned above The SCONUL "Seven Pillars Model" (2011b), and Reedy and Goodfellow's "Digital and Information Literacy Framework" (2013). Both rubrics utilise a 'novice-to-expert' construction.

Unlike the cookbook approach, Information literacy tries to move away from conceptualising the problem purely in terms of absence of technical knowledge or technique. Nevertheless, extracted competencies acquired by one-off demonstrations and rated by single ability standards suggest that the implied deficit is a competence deficit which might also be construed as an information deficit or an education deficit.

Novice/Expert

The novice-to-expert construction of digital literacy found in the two rubrics setting out information literacy standards presage another way to understand the 'gap' in mastery of educational technology that leads to non or poor use. Novice-to-expert constructions posit the technological mastery problem as developmental. While this reading might be taken as another form of information or education deficit, expertise is not only the goal but progress towards it (progression is also an inherent property of this perspective) is achieved by incremental steps towards expertise, moving along a necessary continuum. The transition from novice to expert is therefore best characterised as implying a developmental deficit.

The idea of the expert pedagogue precedes the idea of the expert online pedagogue. The literature on teachers' professional development which used a novice/expert divide as an explanation began in the classroom. From teaching students it was adapted to teaching the teacher (Berliner, 1986; Kagan, 1992). From there it provided a ready-to-hand frame for educating online instructors and for analysing their use of educational technology. Kagan's (1992) literature review constructs the acquisition of teaching expertise developmentally as one of "growth" and lists five steps to professional growth:

1. An increase in metacognition
2. The acquisition of knowledge about pupils
3. A shift in attention
4. The development of standard procedures
5. Growth in problem solving skills. (p. 156);

These steps were variously added to and adapted by subsequent writers on professional development for online educators. As an example, Meskill, Mossop, DiAngelo and Pasquale (2002) adapted novice /expert criteria first developed in classroom settings to create a model of expertise in a technological setting. Meskill et al derive a "novice expert continua" (p 3), in which broadly, novices focus on the machine, its apparent agency in their own relationship with it and how it can manage student behaviour. They tend to treat student skills as being mastery of the computer and outcomes as product-like. Experts by comparison focus on student learning, empowering students to learn, and on the process of learning itself. This distinction between a computer oriented understanding of online instruction where the computer or the instructional content does the teaching, held by novices and the pedagogically oriented understanding held by online instructional experts is echoed in several other studies (Fidalgo & Thormann, 2012, p. 2; Lane, 2008, pp. 5–6; Morris, Xu, & Finnegan, 2005, p. 78; Pierson, 2001, pp. 419–420). Conrad (2004, pp. 39–40) offers an alternative distinction as the salient difference, between novices' adherence to content based delivery over experts' development of socially-constructed environments that connect with students.

Interestingly, the same model of novices concerned with the mechanics of computers and/or content information, and experts concerned with pedagogy and learning design also appears as a feature of professional development training for faculty in online education. Meyer (2014) remarks that the different types of content for faculty development have changed over time. From early examples of "Just tell them 'how the available technology works' and 'how to apply the Technology'"(p. 95), professional development for online teaching now emphasises pedagogy and instructional design. However despite the existence of a very large body of research on expertise and technology as a whole (some examples of which are Collins & Evans, 2009; Dreyfus, 1984; Dreyfus, Dreyfus & Athanasiou 1986 ; Erikson & Charness, 1994; Charness, Feltovich & Hoffman 2006) little or none of this literature on technological expertise appears to have influenced the novice/expert approach

as applied to professional development in educational technology use.

Implicitly, the novice/ expert perspective on technology use amongst academic teaching staff demonstrates a concept of 'use' as occurring along a developmental continuum, somewhat in the manner of Piagetian developmental stages. It is hard to tell whether these developmental stages are understood to be lock-step, or whether there can be movement in either direction through them. In some analyses such as Meskill, et al, (2002), these stages are explicitly spelt out. In other work they are not, but a transition between a 'novice' functional approach and an 'expert' relational and communicative approach to pedagogy is implied by writers who adopt this analysis.

The interpretation of the constitution of knowledge, in the novice/expert formulation is more sophisticated than the mere acquisition of information. Knowledge has lost the object like construction of cookbooks and information literacy in its more instrumental renderings, and is itself the thing to be transformed. The concrete knowledge formulations of novices concerning computers and content are modified by steps into much more abstracted conceptualisations of online education. The agency of the technology user is still however treated as neutral. By and large, the organisational, interpersonal and emotional context, as well as motivations and dispositions of novices and experts are left out of this discourse.

Between neutrality and personality

The three bodies of writing so far examined, whether they interpret the gap to be covered in mastering the use of educational technology in terms of skill or ability deficits, information deficits, learning deficits, or developmental deficits, primarily locate acquisition of technology use as a matter of learning in some form. Needing to learn, from the perspective of that person providing the learning - the professional developer or information provider - does not, or should not imply that an inability to understand or perform on the part of the technology user is because of some defect in that user. Rather, (at least in modern times) it is the responsibility of the professional developer or information provider to analyse and overcome that shortcoming. Situating the responsibility for change with the person or system instructing the user appears to result in the agency of the user in mastering technology being characterised as generally normatively neutral, and not part of the deficit.

The second major literature grouping addressed below, however, reverses that neutrality. Publications concerning 'digital natives/immigrants' and 'diffusion of innovations' focus much more intensively and specifically on academics' use of information and educational technology. They also introduce ideas of the importance of users' dispositions or attitudes. The deficit to be overcome is understood as some property of the user of the technology, by dint of a variety of intrinsic causes. While intrinsic causes may be 'no fault' in some readings, other analyses introduce a notion of responsibility or even culpability on the part of the user for their own technological inability.

A further difference between the two major groupings concerns implicit theories of change. The first three bodies of work contain a gradualist, cumulative idea of progress towards an ideal state of 'using' educational technology. As a theory of change it emphasises continuity. The second literature grouping however, conceives of change as discontinuous, suggesting that disruption or breaks occasion a contingent sometimes revolutionary change. Prensky's "digital natives, digital immigrants" is one such theory.

'Digital native/immigrant'

'Digital native/immigrant' literature could be considered one of the most foundationalist of literatures of technology use, depending as it does on a deterministic idea of the relationship between generations of technology users, brain development and the capacity to learn. What makes it useful for this discussion is that it draws attention to the differences between student users of digital technology, including online learning technology, and the use by their teachers of the same technology.

Marc Prensky (2001a, 2001b) divided users of internet technology into two primary groups in the pair of essays which initiated the controversy over the legitimacy of the division. He named them 'digital natives' and 'digital immigrants'. The essence of Prensky's argument is that digital technology has caused a fundamental break or discontinuity between the people who were born with it and who grew up using it - digital natives, who he argues have "changed radically" (2001a, p. 1) - and those who had to learn how to use it after its introduction - digital immigrants. This break is so significant in his estimation, that he calls it a 'singularity' – "an event which changes things so fundamentally that there is absolutely no going back" (p. 1). The cause of this disruption is that students have grown up surrounded by a ubiquitous environment of digital technology and as a result "think

and process information fundamentally differently from their predecessors" (p.1). Moreover this revolution, Prensky argues, has physically changed students' brains. Amongst some followers of Prensky this argument turned into an extreme claim for brain alteration in digital natives, including attributions of a rise in ADD diagnoses, social isolation, and "internet addiction" (Small & Vorgan, 2008, p. 48-49). This revolution left 'digital immigrants' adrift, doomed to make their way as best they could in a world they could never fully understand. "Today's older folk were 'socialized' differently from their kids, and are now in the process of learning a new language. And a language learned later in life, scientists tell us, goes into a different part of the brain" claims Prensky (2001b, p. 1). By invoking brain changes as the foundation of difference, Prensky underscores the gulf between the two groups of users as deeply as he can.

Prensky's ideas were almost immediately taken up by writers who, feeling themselves in the middle of a digital revolution, were keen to have graspable explanations, especially for students' apparent ability to handle the newly introduced technologies. Proponents included Barnes, Marateo, & Ferris, 2007; Cowling, 2012; Kurhila, 2006; McHaney, 2011; Oblinger & Oblinger, 2005; Phillip, 2007; Trinder, Guiller, Margaryan, Littlejohn, & Nicol, 2008. Many of these authors, like McHaney (2011), understand the advent of 'tech savvy millennials' on campus as an 'inexorable influx' of a 'seismic force' which calls for a complete rethinking by academics of teaching and technology use. However subsequent studies suggest that students in fact use a limited range of technologies for learning and socialising. In particular, students were frequently found to have similar hesitations in using academic technology from LMSs to Library databases as those experienced by academics (Bennett, Maton, & Kervin, 2008; Helsper & Eynon, 2010; Jones, Ramanau, Cross, & Healing, 2010; Margaryan, Littlejohn, & Vojt, 2011). Kennedy et al (2009) for instance, found that there is little empirical evidence for the construct of 'digital native/digital immigrants', and that "[t]here is great diversity in students' and staff experiences with technology, and their preferences for the use of technology in higher education" (p. 3). Selwyn's (2009) explanation for the rash of interest in the idea is that the discourse of 'digital natives' is one of moral panic over the uncontrolled access to and use of technology by 'youth'.

Despite keen interest in the 'digital native', few studies have examined the attitudes and practices of 'immigrant' academic educational technology users, or tried to look at their technology learning behaviours. Margaryan et al (2011) for instance, discuss the 'digital immigrant' but collapse into the category the older student with older academics. However there are two notable exceptions, studies that address staff attitudes and experience more or less symmetrically with that of students. Waycott, Bennett, Kennedy, Delgarno and Gray (2010) report that while staff and students took different perspectives on the purpose of the technology, "[S]taff ... identified benefits relating to improving student learning, while students highlighted the convenience technologies provided" (p 1207), nevertheless they shared concerns about the limitations of educational technology use in teaching and learning. "Both groups mentioned usability issues, concerns about replacing face-to-face interactions, and communication issues" (p 1208). Salajan, Schönwetter, & Cleghorn, (2010) traced both groups experience of the introduction of Blackboard. They found that although students and staff started out with relatively high expectations of it, by the end of the year in question, their expectations had dropped significantly. Academics expectations however, dropped more significantly than students' expectations. Thus there does not in either case appear to be a clear trajectory of educational technology use or supportive literature which unambiguously attaches to 'changed brains' or two separate demographies of users.

While it is fair to say that actual evidence for a "digital native/digital immigrant" divide is at best mixed, its influence as a discourse persists, permutating explanations of how academics adopt educational technology. Underpinning this discourse in addition to a 'revolutionary' and discontinuous theory of change, is a technologically determinist understanding of the nature of knowledge as 'hard wired' into brains by the experience of technology (see Oliver, 2011, p. 375). The locus of divided ability is in the culture or environment of upbringing. Thus the deficit proposed by Prensky could be characterised as a cultural and accumulated environmental deficit. This deficit formulation comes down harder on academic staff however. Bayne and Ross's (2011) deconstruction of the digital native/immigrant opposition is a demonstration of a passive agency which can be extended to all deficit theories which pertain to the absence of skill, ability, information, learning, competence or development, amongst academic users of online learning technology, but especially those which signify the cause of the gap as stemming from some kind of demographic or developmental explanation. They understand this discourse as "the de-privileging of the role of the teacher". They analyse it thus: "Drawing on the terminologies evident in the large popular literature, and the smaller academic literature on this theme, we might extract the following:

native	immigrant
student	teacher
fast	slow
young	old
future	past, or 'legacy'
multi-tasking	logical, serial thinking
image	text
playful	serious
looking forward	looking backward
digital	analogue
action	knowledge
constant connection	isolation

(Adapted from Bayne & Ross, 2011, p. 161)

They summarise this series of binaries by observing:

> What we then see here is a structurally embedded de-privileging of the role of the teacher, aligned with the 'immigrant' position – the old, the past, the slow, the backward-looking, the association with modes of knowledge construction becoming 'obsolete', and dependent on analogue (print) technologies. (2011, p. 161 see also Rose, 2003, for a discussion of the reward for smart computer users and the pathologisation of reluctant users across the workplace.)

Passive or neutral agency, however, is a more forgivable deficit than complicity in ‘resistance’, an underpinning of the discourse in the next group of theories.

Diffusion of Innovations and the Technology Adoption Model (TAM)

Rogers "Diffusion of Innovations" (1962) theory is hugely important both to designers of technology and to educational theorists attempting to explain adoption of technology. At the time of writing, Google Scholar had registered 47667 citations of the book. It is widely used as the theory of choice for studies of the uptake of e-learning by academics in universities (Giardina, 2010; Roca, Chiu, & Martínez, 2006). Roger's model consists of three parts, an innovation, an adopter and ‘diffusion’. The innovation itself must include ‘relative advantage’ - an improvement over previous ideas; ‘compatibility’ - it must be consistent with the needs of adopters; ‘degree of complexity’ - it must be simple to use; ‘trialability’ - it should allow for experimentation; and ‘observability’ - it should be readily visible to others (Rogers, 1983, pp. 14–16). Comparative levels of these characteristics determine its desirability to adopters. Rogers also describes the qualities of the technology user. These are ranged along a scale showing the ‘innovativeness’ of the individual (p 22). He isolates five categories of adopter to each of which he allocates a standard deviation of a normal distribution curve. Innovators' constitute 2.5% of the adoptive population; early adopters, 13.5%; early majority, 34%; late majority 34% and 'laggards', 16% (Rogers, 2010, pp. 279 – 280) The actual process of diffusion is defined by Rogers as;

> ...the process by which (1) an innovation is (2) communicated through certain channels (3) over time (4) among the members of a social system. The four main elements are innovation, communication channels, time, and the social system. (Rogers, 1983, p. 11)

Roger's diffusion of innovation theory sits like an atomic nucleus inside an electron cloud of offshoot theories and models for which it provides a conceptual basis. As information systems researchers became more interested in the problem of adoption due to increasing failures of organisations to effectively adopt information systems so they turned attention to modelling human behaviour in much the same way as technical systems were modelled (see Chuttur, 2009). I.S. researchers found Roger's model too complex, so their subsequent models were an attempt to both simplify and rationalise adoption. This gave rise to a plethora of models with acronyms, united in both modelling technology adoption, and in paying closer attention to the user. Early offshoot models of adoption include attempts to address the educational development of users, such as the 'Concerns Based Adoption Model' (CBAM) (Hall, Wallace, & Dossett, 1973). Hall et al. credit Rogers as a foundational influence but they reframe Roger's problem from the way technology might address the needs of the user and instead focus on the adopter's problem solving capacity and agency. This model too was understood to be overly broad and complex by some researchers.

A second model was more successful in gaining interest. Researchers seeking adoption models with methodological rigour sufficient to produce reliable measurements found Davis, Bagozzi, & Warshaw's, (1989)

Technology Adoption Model (TAM) very useful. TAM itself is an attempt to create a statistically predictive model of use based on two attitudes or beliefs; degree of perceived usefulness and amount of perceived use. Davis, Bagozzi and Warshaw assert that the non adoption problem is one of 'resistance' and that adoption is best explained by 'intention' to adopt (p 982). Their orientation is entirely to the concerns of "IS practitioners" (p 999), those people in organisational IT departments whose job it is to implement systems that work, at least from the perspective of acceptability. The model is adapted from 'intention models' of social psychology, in particular, Ajzen and Fishbein's (1980; 1975) model of reasoned action (which Davis et al cite; 1989, p. 983). The TAM model prefers to address extrinsic motivators suggesting this in turn is mediated by perceived usefulness and perceived ease of use. TAM itself represents the origin of a major research bifurcation in that 'intention to use' and 'usability' became separate objects of study. 'Intention to use' led to further developments in motivation studies, and continued to foreground the teachers' intrinsic qualities, while 'usability' studies researched technology design as the figure against the ground of user behaviour. The TAM model gave rise to many variants; TAM2 (Venkatesh & Davis, 2000), TRAM (Lin, Shih, & Sher, 2007), and TAME (Ahmad, Madarsha, Zainuddin, Ismail, & Nordin, 2010), as well as general tweaks to the model without renaming it (Cheung & Vogel, 2013; Roca et al., 2006; Stewart, Bachman, & Johnson, 2010). While varying in the extent to which they cast the user as an active impediment, these variants follow the model of denoting 'intention to use', formed by other behavioural factors which vary slightly from model to model, as central to understanding adoption. In fact some believe that the plethora of 'patch up' models to TAM has led to theoretical chaos (Benbasat & Barki, 2007).

In the literature on educational technology the perspective that casts academic instructors as resisters forming barriers to adoption is quite extensive (Bruner, 2007; Gutman, 2012; Lesht & Windes, 2011; MacKeogh & Fox, 2009; Mirriahi, Dawson, & Hoven, 2012; Newton, 2002; Quinn, 2012; Tabata & Johnsrud, 2008). Very occasionally this literature, while still adopting the 'resistance' frame, argues that the meaning of non-compliance to academics ought to be understood (Selander & Henfridsson, 2012; Sobreperez, 2008).

Along with providing a core theory for models describing the transfer of innovation, the legacy left by Rogers is 'resistance'. Rogers quite frequently uses the term 'resistance' to mean non adoption, despite positioning non adoption as a rational choice (see e.g., Rogers, 1983, pp. 27, 198, 205, 250, 349). Other authors also use 'resistance' as synonymous with any non compliance, casually and without examination, understood as the cause of non adoption. Resistance is never constructed as a Foucauldian counter-power or as a labour-process issue, in this discourse (Braverman, 1974; Foucault, 1995). As a counter-power, resistance might be understood as a rational reaction to an overly constricting or incomprehensible medium from the perspective of the user. Rather in diffusion of innovation based models, resistance is an impediment seen from the perspective of managers and technicians. It does not take a great deal for 'resistance' to be recast as 'barriers' to adoption and for academics to be so classified, along with other organisational features e.g., Reid's (2012) five barriers; technology, process, administration, environment, and faculty(figure 1, p. 3).

Rogers approach is steadfastly instrumentally rational. He understands motivation to be quantifiable and he has a Durkheimian propensity for discriminating 'social facts' and to isolating the pathologies of a social group. The theories of agency, knowledge and social change inherent in diffusion of innovation and TAM type models are radically different from other discourses discussed. While the agency is of the user is understood to be more or less under that user's control, being a matter of disposition or motivation, the effect of it is structural, as the user is made object-like, constituted as a barrier, an obstacle to implementation of educational technology. Knowledge is made completely agentic, becoming a matter of the users' intention to grasp it. Social change however is formulated as a discontinuous process, progressing in fits and starts against the odds of disruption and resistance. The role of facilitating adoption has made a transition from a supporting and normatively neutral educative approach to the user, to a discourse which easily slips into blaming the user for their own inability or disinclination to use educational technology. The deficit, a matter now of character, is clearly in the user.

Conclusion

The deficit theories explored in this paper are arranged to suggest a typology. Cookbooks and lists and Information literacy deal with lack of use or poor use as an immediate problem, although information literacy takes slightly less of an immediate focus. This close and time limited focus strips out context, flattening concepts of the user into a mere psychological stick figure, lacking both individuality and social context. As users are parsed into a simplification, so solutions can take on a mechanical quality, where 'add information' is the answer, but that information itself is also objectified. As more psychological and social context is added, as in novice expert and digital native digital immigrant orientations, so the user becomes more visible. This adds complexity to theories of knowledge acquisition. While both novice expert and digital native - digital immigrant

theories posit a form of developmental deficit, they are divided by ideas of mental flexibility. This is tied into how remediation is understood. If it is understood as a matter of more information or education, then mental agility or motivation in the user is not problematised. Once explanations flip over to targeting characteristics possessed by the user, then although the time frame considered is extended and the psychological and social context of the user is added, these are understood as a huge impediment to mental flexibility and therefore to change. The temptation to blame the user creeps in. Change in use takes place through disruption to these later forms. The responsibility for disruption however lies primarily with the technology in digital native/immigrant theories and with the user in diffusion of innovation/TAM theories. Thus an overall typology has axes that run from simple (or no) personhood to a contextualised personhood established over time. But at the same time as personhood is established, however, so is culpability in one form or another.

Engaging in deficit thinking about the users of educational technology thereby locks researchers into quite specific forms of problematisation and eventually into convergent solutions. Re-problematising the question of what users are motivated by, and how their behaviour and beliefs are understood, opens up new possibilities for research into educational technology use. Alvesson and Sandberg (2013 pp 47-48) understand gap-spotting and problematisation as two distinct but not mutually exclusive ways of constructing research questions. Both styles of question production are based in literature review, but while the former tends to reproduce the perspective of the existing research, the latter encourages the challenging of fundamental assumptions. The reframing that results can materially challenge and change how we constitute and delineate knowledge of educational technology use.

Deficit theories do not characterise all literature that attempts to explain or redress difficulties in implementing educational technology. Critical literature for instance may use the word 'resistance', but takes away the deficit approach by either writing from the perspective of the user (Hannon, 2008; McShane, 2000) or by pointing to the construction of the debate (Selwyn, 2007). Writers who emphasise the phenomenological (Cigdemoglu, Arslan, & Akay, 2011; Cilesiz, 2011) or who have integrated technology as part of the explanation (eg the broad literatures of social studies of technology , including social construction of technology and actor network theory) use quite different explanatory frameworks consistent with arguing markedly different formulations and locations of agency and structure. I intend to address more comprehensively in a future discussion, how such critique may inform alternative perspectives.

Deficit thinking also entails an ethics. The idea of a deficit posits the idea of a flaw in some form. It suggests that without it a complete whole, perfection, would otherwise exist. Managers, professional developers, educational technologists or academics who accept deficit theories located with the user are also saying that their methodologies, pedagogies, teaching practices, technological systems and organisations are not responsible for this flaw. Moreover those who subscribe to and describe deficit theories, position themselves as the experts in possession of that ideal expertise. Such techno-utopianism (Goldberg & Riemer, 2006; Njenga & Fourie, 2010) allows theories of adoption to be driven by instrumentality, since if ends are good, then it can only be means which are problematic. But the focus on the gap between the expertise of the self and the ignorance and incapacity of the other also bespeaks a techno-narcissism.

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