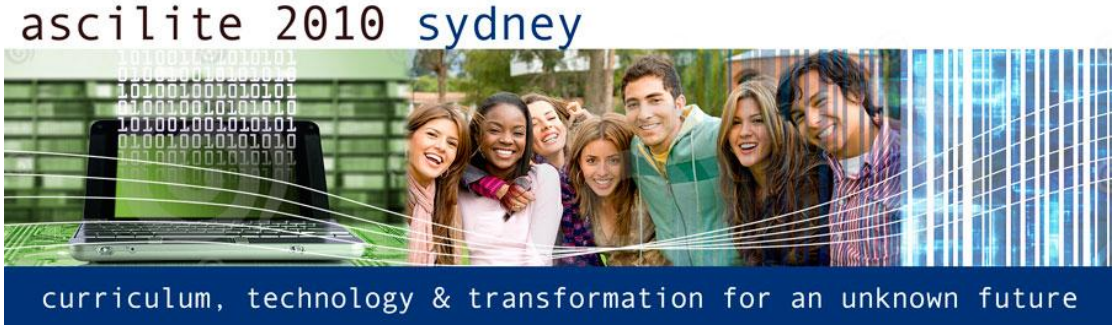

Technology enhanced learning – where's the evidence?

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This paper reports on a UK Higher Education Academy funded project investigating the use of technology to enhance student learning in higher education. It reviews the literature to explore what evidence exists to illustrate that technology enhances learning, and how this evidence changes the practice of teachers in higher education. The contested nature of evidence, and of enhancements in student learning are discussed. The findings indicate that while the use of technology may enhance learning, the evidence supporting these claims is tangential, as is the evidence illustrating changes in the practices of HE teachers.

Keywords: technology enhanced learning, evidence-based practice

Introduction

The use of technology for learning and teaching brings optimism and opportunity for education. It liberates both the teacher and the student in the scholarly enterprise by removing traditional boundaries and restrictions to knowledge via the open and ubiquitous access that it offers (Katz, 2010). However, it also challenges us to consider the best possible uses of that technology for our students and, more fundamentally, our actions as educators in the process of exploiting technology for pedagogical advantage (Kirkwood & Price, 2005).

The term *technology enhanced learning* is used extensively throughout the educational world; it is the latest in an assortment of terms that have been used to describe the application of information and communication technologies (ICT) to learning and teaching. Unlike other terms such as e-Learning or on-line learning, *technology enhanced learning* implies a value judgement: the word 'enhancement' suggests an improvement or betterment some way. However, it is rare to find explicit statements about its meaning. How does technology *enhance* learning – what is the 'value added'? What *learning* is being enhanced and in what ways – is the enhancement quantitative and/or qualitative? A more fundamental question is whether there is a generally accepted view of what constitutes *learning* in higher education and of how it can be *enhanced*?

Although there any many examples of innovative uses of technology in learning and teaching it is not clear whether these actually *enhance* student learning. More readily observed is the use of technology to support or replace existing teaching practices, with limited evidence to confirm any enhancements to the status quo. To date there has been an over-emphasis on technological manifestations and this has led to the omission of pedagogical considerations (Beetham, 2007; Conole et al., 2008; Kirkwood, 2009). Some years ago, a survey of the adoption of online learning environments in UK FE and HE institutions concluded that "pedagogical issues ... appear to have been of secondary concern until now" (JISC/UCISA, 2003, p. 7). Reviews of technology use in universities in other Western countries revealed similar shortcomings (Becker & Jokivirta, 2007; Kirkwood & Price, 2005). There does not appear to have been a marked change in this situation. Even where pedagogical considerations have been taken into account there is a more general problem that blights the use of technology in education,

namely a lack of evidence of its impact on changing practice. Reviews of learning technology use in UK universities found that most projects failed to capitalise on existing knowledge of learning and teaching with technologies and that many projects could have been improved if they had applied previous evidence discovered on effective use (Price & Kirkwood, 2008). So why might this be that case?

Research into HE shows that university teachers hold a variety of conceptions of teaching. These range from transmissive approaches to student-centred (Prosser, Trigwell, & Taylor, 1994). Transmissive approaches are underpinned by the notion that knowledge is molecular and that teaching is the communication of knowledge. These are more evident and problematic in ICT environments, particularly where little is done to reform or enhance students' experiences of learning (Kirkwood & Price, 2005; Sept, 2004). However the link between the conceptions of teaching and practices in teaching is not straightforward. While teachers may profess particular beliefs about teaching, their practices do not always match those beliefs (Jelfs, Richardson, & Price, 2009; Norton, Richardson, Hartley, Newstead, & Mayes, 2005; Price, Richardson, & Jelfs, 2007). Argyris & Schön (1974), have previously observed that professionals might espouse one theory and use another in practice. It is not sufficient for university teachers simply to know about what constitutes effective teaching, as actual practice is influenced by many additional factors. Fanghanel (2007) argues that individual experiences, pragmatic preferences, and cultural and ideological backgrounds account, to a greater or lesser extent, for the positioning that academics adopt. However, what factors might influence academics to adopt particular positions or, more importantly, to change their practices. Teachers find it easier and less threatening to reinforce, supplement or replace existing teacher-centred practices with technologies rather than to reassess the fundamental basis of their practices. Less student-centred approaches to teaching become more evident in technologically rich environments and typically lead to the *translation* of existing practices as opposed to *transformation* (Petre, Carswell, Price, & Thomas, 1998). So given these difficulties in changing teaching practice can technology alone be responsible for enhancing student learning?

Given that the use of Web 2.0 tools is becoming widespread, particularly with the 'Net' generation (Jones & Cross, 2009; Kennedy, Judd, Churchward, Gray, & Krause, 2008), we need to understand how such tools can support student learning appropriately for a networked society. The problem appears not to be technological but pedagogical: knowing *why* and *how* to use technologies *effectively* in practice is a complex matter (Bostock, 1997; Kirkwood & Price, 2005; Laurillard, 2002; Price & Kirkwood, 2008). But how do academics change their practices and what evidence influences such changes? And what evidence is there of changes in the teaching practices in the use of technology that have actually enhanced student learning? This study explores some of these issues by reviewing some of the available artefacts that describe the use of technology in learning and teaching. The goal was to examine what might constitute evidence and how it enhances student learning.

So what is evidence?

This is a highly contentious issue in the field of student learning in higher education. The term evidence is an ambiguous concept. In theoretical terms, determining what counts as evidence is foreshadowed by the epistemological positioning of the person either presenting or interpreting the evidence. Evidence may be understood as the demonstration of a truth, but the interpretation of truth as objective, subjective, absolute or relative, influences what is acceptable as truth and hence evidence. Thus in what circumstances is it possible to 'know' that the evidence presented is directly attributable to any claim? And is it circumstantial in that it only reflects an inference that requires other similar forms of evidence to corroborate it? The use of a scientific approach to acquiring and presenting evidence is often adopted. However that tradition presents problems when considering the activities of humans. The gathering of scientific evidence is directed at the acquisition of data, typically in laboratory settings, where conditions can be controlled, focused on rejecting or supporting a hypothesis. In contrast, the gathering of evidence from humans, particularity in real or naturalistic educational settings, is neither controlled nor can it be observed as discrete entities. Hence the concept and manifestation of evidence in higher education is problematic, both in terms of its acquisition and in its interpretation.

Although the notion of gathering and demonstrating evidence of enhanced student learning with technology is problematic, we still need to gather evidence despite the difficulties. Adopting an evidence-based approach to learning and teaching practice, particularly given societal changes in the

extent to which technology is embraced, is essential for the thriving provision of high quality university education. Higher education is often criticised for its inability to respond to changes in practice and, in particular, for the lack of available evidence to support claims about specific uses of technology in enhancing student learning. So is it that the evidence is too contentious to get enough agreement to make assertions? Is it too limited? Is it of poor quality? Or is it that the evidence is not readily found in mainstream journal articles or in other easily accessible places? Reviewing the literature on uses of evidence in enhancing learning and teaching practices with technology raises some important questions about what counts as evidence and how it might support practitioner's daily practices.

In understanding what counts as evidence it is important to also consider the context within which it will be used. With these issues in mind, we suggest the following framework for examining evidence in order to characterise the context within which it is gathered and its possible impact. Evidence is characterised in two ways: first, in terms of the type of evidence provided; and second in terms of its potential impact. We suggest that these are cross referenced against each other in a matrix.

Types of evidence

1. *Accounts of innovations:* These are descriptions of how technology has been used in higher education. The evidence provided is typically of a less formal nature including anecdotes, observations and questionnaire data, including measures of student satisfaction.
2. *Lessons learned:* These are accounts of learning and teaching with technology and lessons have been learned from their use. They include evidence ranging from formal to informal forms of data collection, including both qualitative and quantitative data. The data will also range in nature from weak to robust data collection methods.
3. *Changes in practice:* These provide good examples of how evidence (e.g. of aspects that learners find troublesome) has been used to drive an investigation into innovations in technology in learning and teaching, followed by an evaluation of that application's effectiveness for student learning. This evidence is then used to drive changes in practice.

Impact of evidence

a) *Micro:* These changes are usually confined to a level local to the teacher or classroom or a particular course.
b) *Meso:* These changes are usually within a department, faculty or institution and will have impact on more than one course.
c) *Macro*: These changes impact on more than one institution at national level and may also have impact on institutions in different countries at an international level.

Hence it is possible to have evidence reported that is an account of an innovation that has an impact at a micro level such as in the classroom. There may also be evidence reported as an account that has an impact at a macro level which impacts on a national or international basis.

So what is an enhancement in student learning?

A recent review of the research literature (Hrastinski, 2008) identified six differing conceptions of 'online learner participation' within 36 articles. The researchers/authors of those articles had been looking for different forms of learner activity as evidence of 'online participation'. These ranged from simple criteria such as 'Participation as accessing e-learning environments' and 'Participation as writing' to more complex criteria reflecting the purpose of the participation:

> It was found that research is dominated by low-level conceptions of online participation, which relies on frequency counts as measures of participation. However, some researchers aim to study more complex dimensions of participation, such as whether participants feel they are taking part and are engaged in dialogues, reflected by using a combination of perceived and actual measures of participation. (Hrastinski, 2008, p. 1761)

So why is there such variability in the conceptions used by the researchers/authors of these articles? It could be argued that some researchers have chosen to use measures of participation that are easy to quantify and/or do not involve value judgments having to be made. But by focusing on an objective quantitative measure of 'participation' they have completely avoided engaging with any qualitative

concerns with the learning that is supposed to be facilitated by online participation. The various criteria applied by the researchers appear to reflect fundamental differences in the conceptions of what *learning* and *teaching* involve. Such differences have been found among university teachers in a number of countries.

Several studies (Kember & Kwan, 2000; Samuelowicz & Bain, 2001, 1992; Trigwell & Prosser, 1996) have demonstrated that the conceptions of teaching held by HE teachers relate to how they approach their teaching. Teachers who are primarily concerned with 'the transmission of knowledge' are likely to exhibit a teacher-centred approach aimed at imparting their knowledge to students. In contrast, teachers who see their role as facilitating learning, adopt student-centred approaches to teaching aimed at developing students' understanding of a topic. A relationship has also been demonstrated between a university teacher's *approach to teaching* and the *approach to learning* exhibited by their students (Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006; Trigwell, Prosser, & Waterhouse, 1999).

So if university teachers hold differing conceptions about the nature of teaching and learning, how is this reflected in their assessment practices? What would they be looking for to indicate an 'enhancement' in student learning? Unsurprisingly, an individual teacher's assessment practices follow from their overall approach to teaching, i.e. teaching-centred or learning-centred (Samuelowicz & Bain, 1992). If their approach to teaching is primarily concerned with instruction and transmission, then the associated assessment will be *quantitative*, focusing on determining *how much* knowledge has been transferred to the learners. Hence learning will be considered 'enhanced' if students gain more marks and have acquired more knowledge. In contrast, if the teaching approach is more concerned with enabling learners to develop their understandings, assessments would enable students to demonstrate *qualitative* changes in their ways of thinking, not just the quantitative acquisition of knowledge. For such teachers any 'enhancement' would need to demonstrate that their learners' conceptions had been changed or developed. In the next section we will consider how and why these differences in conception have come about.

Student learning has been researched for many years. Twentieth century views on education were based around the school system based on 'commonsense assumptions that had never been tested scientifically' (Sawyer, 2006, p. 1). These were based upon what Papert (1993) characterised as instructionist approaches to learning. These can be summarised as:

- Knowledge is a collection of facts and procedures
- The goal of school was to get the facts and procedures into learners' heads
- Teachers' jobs were to transmit the facts and procedures to learners
- Simple facts and procedures are to be learned first followed by more complex ones; sequencing of these was determined by teachers, authors, or professionals in the field
- Successful learning was determined by testing learners on how many of these they had acquired (see Sawyer, 2006, p.1, for a full description).

Research into learning did not begin until the instructionist model was well established. Around the 1980s it became recognised that learners could generalise their learning and apply it to a greater range of contexts when they engaged in learning the concepts rather than memorising facts and procedures (Entwistle & Ramsden, 1983; Marton & Säljö, 1976; Sawyer, 2006; Richardson, 2000). The United States National Research Council (see Bransford, Brown, & Cocking, 2000) reached a consensus that instructionism was flawed and that a deeper conceptual understanding enabled the learning of facts and procedures in a more useful way that allowed better generalisation and transfer to greater range of contexts. Although research into learning was happening in different traditions an overarching principle emerged: learning is a deeper conceptual understanding characterised by qualitative changes in the learner. Papert (1993) argued for a shift from instructionist approaches to constructionist approaches that allowed children to develop their own knowledge through the act of constructing: 'the goal is to teach in such a way as to produce the most learning for the least teaching' (p.139).

This issue is problematic in higher education too: differences between what is 'taught' by teachers and what is 'learned' by students are acknowledged (Snyder, 1971). The memorisation of facts and figures is ill-matched to the needs of a knowledge-based economy (Bereiter, 2002; Hargreaves, 2003). The demands of westernised economies require learners to act as professionals, able to construct new knowledge and ideas and take responsibility for their own continual learning during their lifetime

(Sawyer, 2006; Sharples, 2000). The challenge for learners has shifted from being able to remember and repeat information to being able to find it and use it appropriately (Bransford et al., 2000).

There are many different disciplinary approaches to researching learning. The behaviourist tradition would argue that learning is a permanent change in behaviour. And hence as a change in behaviour it is observable. Bloom (1956) developed his well known taxonomy of learning objectives classifying a hierarchical series of pre-requisites to higher forms of learning. This suggests a developmental approach where students' skills in learning develop through acquiring knowledge, understanding, application, analysis, synthesis, to evaluation.

In comparison, constructivism argues that humans develop their own understanding of their world through their experiences and interactions with that world (Bruner, 1990; Piaget, 1972). As an individual accumulates new knowledge they reconfigure their mental models to accommodate new knowledge in order to understand it and make sense of it. Constructivism differs from instructivism in that learning is not considered in terms of the quantity of knowledge but that it is qualitatively different. This resonates with Bloom's view that learning is developmental and qualitatively, not quantitatively richer.

Marton & Säljö (1976) explored qualitative differences in the meaning and process of learning in higher education. They found that students described learning in different ways, which they categorised hierarchically into developmental conceptions of learning. These encompassed a qualitative change in the learner from *learning as memorisation to learning as an interpretative process in understanding reality*. A sixth conception, *learning as developing a person*, was later added (Marton & Säljö, 1997). Unlike constructivists, phenomenographers investigated the conceptions that individuals expressed. They related these conceptions to surface and deep learning. These conceptions provide explanatory sources of variations in the production of learning outcomes (Meyer, 1997). More recent research has shown that the development of conceptions are in relation to perceived demands or particular circumstances (Halldén, 2001; Halldén et al., 2002).

> Learning is not to be looked upon as a linear process in which we first learn 'facts' … and then try to understand these facts… Rather learning is to be regarded as a simultaneous processing of these levels where the learner is continuously oscillating between [them]… In the beginning … both the understanding of the meaning of facts and the theoretical understanding are vague… When we are trying to learn something entirely new, our point of departure can perhaps only be constituted by common speech genre. However, when knowledge grows, the theoretical understanding as well as the ability to interpret empirical evidence become more articulated… If instruction is linearly organised, or if the theoretical context is not made explicit…, the learner has to invent higher order structures… [from] a common-sense view of the world. (Halldén, 2001, pp. 64-65)

Regardless of the tradition, the common conclusion in characterising learning is that improvements are developmental and qualitatively richer, not just an increase in knowledge. Hence an enhancement is one that supports the qualitative development of learning.

Review of the literature

The literature review used two main approaches to investigating evidence of technology enhanced learning:

- Use of search engines that interrogated databases of journal articles, conference proceedings, etc. The keywords used were: 'technology', 'university' *or* 'higher education', 'teaching' *or* 'learning', 'evidence' and 'empirical'.
- Manual searches for the last 5 years of journals in appropriate areas to ensure that the articles and papers located related to technologies currently available i.e. 2005 to 2010. These included *Active Learning in Higher Education; Australasian Journal of Educational Technology; British Journal of Educational Technology; Computers and Education; Higher Education; Internet and Higher Education; Journal of Computer Assisted Learning; Learning, Media and Technology; Open Learning; Studies in Higher Education; Teaching in Higher Education; Higher Education Research and Development, International Journal on E-Learning, Journal of Technology and Teacher Education, and A*SCILITE proceedings.

Articles were also drawn from our own research experience and knowledge as well as suggestions gathered from colleagues of papers that might be relevant. The abstracts were then scrutinised to ensure that they fulfilled the following criteria:

- The item referred to an innovative use of technology for specific teaching and/or learning purposes in higher education;
- The item referred to an innovative use of technology for specific teaching and/or learning purposes associated with one or more particular courses/modules or groups of students;
- The item provided some form of evaluative evidence of the impact of the innovation described;
- The item provided a literature review of existing studies that fulfilled the previous criteria in this list.

Use of these criteria enabled articles to be eliminated that were wholly or primarily about:

- Technology innovations in schools;
- Students' attitudes to and use of technologies in general;
- Plans for technology innovations that were yet to be introduced with students;
- The generalised or idealised potential or affordances of technologies in education;
- Approaches to professional development for teachers' adoption of technologies;
- Institutional policies relating to the adoption of technologies.

After applying all of the inclusion/exclusion criteria, a total of **50** unique articles and papers were selected for review. When reviewing the articles and papers the following aspects were considered:-

- What evidence was being used to drive the innovation/intervention?
- What evidence was gathered?
- What evidence illustrates changes in professional (HE teachers) practice?

An overview of the type of evidence found in these articles and papers is shown in Table 1. Note that this excludes the 3 literature review articles that relate to variety of studies and contexts.

Table 1: Overview of the type of evidence articles & papers contained

Type of Evidence	a. Micro	b. Meso	c. Macro	**Total**
1. Accounts of innovations	1 *(2%)*			**1** ***(2%)***
2. Lessons learned	30 *(64%)*	9 *(19%)*	4 *(9%)*	**43** ***(91%)***
3. Changes in practice	2 *(4%)*	1 *(2%)*		**3** ***(6%)***
Total	**33** ***(70%)***	**10** ***(21%)***	**4** ***(9%)***	**47** ***(100%)***

The largest proportion of these studies (91%) were categorised as 'lessons learned', with only 6% illustrating any evidence of changes in practice – these all reported modifications with successive student cohorts. In terms of the level of influence, more than two-thirds of these case studies (70%) are at a micro level, i.e. having impact on the local context, typically with small-scale effects. This set of studies covers a wide variety of innovations in many discipline areas spread across a range of countries. Various research approaches were used, from quasi-experimental to case studies. While many of the innovations were designed to replicate or supplement existing teaching practices, some others were focused on new ways of working – either for students or teachers. The approaches and methods used to collect data provide some indications of the ways in which the practitioners/researchers involved conceptualise learning and teaching in higher education and the types of evidence that they consider to be salient.

Inception: In many of the studies there is no indication of the rationale, i.e. what prompted the innovation, other than a desire to experiment with a particular technology or tool. Few describe a teaching or learning issue that needs to be addressed and hardly any examine educational problems or opportunities that their particular students are facing. Although published studies almost always include

a review of the relevant existing literature, in many of these cases there is no indication that findings or evidence from relevant previous studies were considered *before* introducing their innovation.

Evidence sought: Some of the studies reviewed had used quantitative measures as the main form of evidence collected, usually assessment grades achieved or a comparison of pre-test and post-test scores. In some of these cases, however, the design was not robust. It was clear that the innovation itself was not the only variable that could be associated with any differences in scores achieved. The main methods used for data collection in many of the studies relied upon self-reporting by students and/or teachers, for example eliciting their perceptions about the ease of use or effectiveness of the innovation or their attitudes regarding the innovation being used more widely.

Outcomes: In several of the studies one of the main findings was that the innovation had increased the flexibility for students in terms of when and where they undertook learning activities. While this might be very important operational goal, it tells us nothing about any changes or improvements in students' learning. In only a few cases was there any account of 'closing the loop'; of how the findings from the study had influenced subsequent practices. Only 3 of the studies reviewed described follow-through to using the innovation with subsequent cohorts of students.

How has enhancement been reported in studies of innovations?

Some studies used tests to determine whether or not 'learning gains' have been achieved following students' use of the innovation, i.e. have learners scored higher grades on the end-of-module assessment than those who have not used the innovation. This approach has a number of flaws. First, if the innovation has provided additional instructional resources, a simple comparison with the scores of students who have not engaged with the innovation is meaningless. Second, the approach assumes that *enhancement* implies a quantitative improvement (i.e. more has been learned) and probably reveals nothing about whether students' have a qualitatively deeper understanding. Third, is the method of testing sensitive to the desired learning enhancement (i.e. multiple-choice or short answer questions are unlikely to reveal qualitative changes in learners' understanding).

So how can an enhancement in learning be characterised? Based on the review presented in this paper, it could be characterising as a developmental qualitative improvement. However the nature of this improvement is contentious. Price and Richardson (2003) argue that improvements in student learning should not solely be characterised by learning outcomes but should also include an examination of the learning process itself. Task and context appear to affect an individual's approach to learning (Laurillard, 1978). (Marton & Säljö, 1984) noted the 'technification' phenomenon where students' study approaches to a task mirrored the task requirement; students were more concerned about being able to answer questions correctly than in adopting a deep approach to learning. Scouller (1998) reported similar findings, particularly in relation to assessment cueing students to adopt particular strategies. So task and context have an impact on how students approach learning and the indirect outcomes. Hence learning outcomes can be distorted by variations in assessment practices – which in themselves can cue students to adopt less desirable approaches to learning (see Richardson, 2000, for a full review).

A widely used questionnaire in higher education that examines approaches to learning is the Approaches to Studying Inventory (ASI) developed by Entwistle (1979), revised by Entwistle & Ramsden (1983), and later developed into a shorter form as the Revised Approaches to Studying Inventory (Tait & Entwistle, 1996). This instrument determines variations in study behaviour. Although the link with academic attainment is not straightforward it 'does tend to be positively related to desirable forms of study behaviour and negatively related to less desirable forms' (Richardson, 2006, p. 869).

Mayer & Boulton-Lewis (1997), in developing the Reflections of Learning Inventory (RoLI), argue for two categories; accumulative and transformative. They argue that conceptions of learning do not operate in isolation of other aspects of learning. In the RoLI, conceptions of learning and other variants are analysed in relation to assessment outcomes (Meyer & Shanahan, 2000). Meyer (1999) has shown that conceptions of learning and the process of learning can influence the outcome. Biggs (1987) used deep and surface approaches to learning to develop the Study Process Questionnaire (SPQ), which was used to describe the preferred ongoing and contextual approaches to learning. This was based on the Biggs's (1985) Presage-Process-Product, 3P model of student learning which shows how different

factors, including students' characteristics, teaching context, learning activities and learning outcomes are all integrated. This model illustrates how students enter the learning environment with a variety of factors, that is, prior knowledge, ability and their preferred approaches to learning. Price & Richardson (Price & Richardson, 2003) added the fourth P – Perceptions – to Biggs's 3P model, arguing that students' perceptions and their conceptions of learning and teachers' perceptions and their conceptions of teaching are important elements that are related to the whole concept of improving student learning. This model shows an interrelationship between the context in which learning takes place, the learner themselves, the teacher and the outcomes. Epistemological conceptions about the process of teaching and learning should be viewed as an inter-related set, as should judgements about enhancements. Miller (2010) argues that in order for technology to be successfully employed, professional development activities of trainee teachers requires a reflective approach to teaching that allows them to reframe their practices in context.

In this literature review we have found limited demonstration of evidence illustrating how technology has enhanced learning. Typically, there was insufficient examination of the pedagogical problem in order to understand whether a satisfactory solution or an enhancement had been achieved. More often than not technology was used to address an under-defined issue. The evidence gathered so far has tended to focus on accounts of technology use, typically of an anecdotal nature and confined to particular local contexts, such as specific classroom innovations. Rarely was evidence used to illustrate how practices had changed for academics. The evidence gathered also lacked pedagogical underpinning in that it was unclear what enhancements in learning had been achieved.

There was limited evidence of theoretical models of learning being used to demonstrate that uses of technology were 'causing' enhancements. Studies that have used models of learning as a theoretical underpinning for examining enhancements have illustrated that learning *does not* appear to be enhanced by the technology (Richardson & Price, 2003). In one example, the use of technology in providing tutorial support was considered by students as detrimental to their experience (Price et al., 2007). A question remains as to whether the evidence is available but is either under-reported or fails to make its way into mainstream journals due to the constraints that journals articles place upon authors and researchers.

So why is evidence lacking?

There may be several explanations for this. Gathering robust evidence is a long painstaking business and generally requires a longitudinal process. The interpretation and use of the word 'enhancement' are all too readily assumed and there is little in the way of clarity that articulates what the range of enhancements might be and how they impact on student learning. Investigating changes in academic practices and gathering evidence that supports any claims is also highly contentious and difficult to gather. This type of research is less attractive to funders.

The context within which academics operate is highly influential (Becher & Trowler, 2001). Academics are typically employed on the basis of their research and are rewarded for research outputs, both in promotion activities and in governmental approaches to funding research (at least in the UK). There is less kudos for teaching excellence than for research, so an academic who concentrates on teaching at the expensive of research risks jeopardising their career prospects. Historically, (at least in the UK), there has been no requirement, by either the sector or by institutions, for academics to have a qualification in higher education teaching or to be an accredited teacher. Most of us would consider it unthinkable to have surgery performed by a doctor who did not have a recognised surgical qualification yet it is possible for an academic to teach at university level without any formal training or qualifications in HE teaching. Another influential factor is likely to be that academics have not been exposed to robust evidence-based approaches to teaching and learning supported by theoretical a grounding. Hence, in comparison with their own discipline/research field, they are less skilled at acquiring evidence about learning and teaching, understanding its nature and its implications, or how and when to act upon evidence in their teaching practice. In the field of medicine, evidence-based practice is recognised at a crucial activity in the training of new doctors in order for them to keep abreast of their field and to implement new practices sooner rather than later. Should we not be adopting the same approach to our practices as professionals in higher education?

Higher Education needs to move towards an evidence-based approach to learning and teaching practices, especially in relation to using technology, wherein we actively examine our assumptions,

seek robust evidence as to effectiveness, and are prepared to change when the evidence indicates this need (Price & Kirkwood, 2008).

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