Using technology for teaching and learning in higher education: A critical review of the role of evidence in informing practice

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The use of technology for teaching and learning is now widespread, but its educational effectiveness is still open to question. This mixed-method study explores educational practices with technology in higher education. It examines what forms of evidence (if any) have influenced teachers' practices. It comprises a literature review, a questionnaire and interviews. A framework was used to analyse a wide range of literature. The questionnaires were analysed using content analysis and the interviews were analysed using inductive thematic analysis. Findings suggest that evidence has partial influence upon practice with practitioners preferring to consult colleagues and academic developers. The study underscored the difficulty in defining and evaluating evidence, highlighting ontological and epistemological issues. The academic developer's role appears to be key in mediating evidence for practitioners.

Keywords: evidence, learning, practice, teaching, technology.

Introduction

There is a growing expectation that higher education teachers should be aware of research into student learning to underpin scholarly practices (Clegg, 2005; Higher Education Academy, 2007; Kreber & Cranton, 2000; Locke, 2009; Trigwell, Martin, Benjamin, & Prosser, 2000). This is important given discourse about the educational potential of technology (Tamim, Bernard, Borokhovski, Abrami, & Schmid, 2011). However there has been limited demonstration of appreciable changes in teaching practices with technology (Kirkwood & Price, 2005; Price & Kirkwood, 2008): more typically practices favour re-enactments of traditional activities in different media formats (Blin & Munro, 2008; Price, Richardson, & Jelfs, 2007; Roberts, 2003). Previous reviews found that many studies failed to capitalise on existing knowledge and that these could have been improved had previous evidence been employed (Kirkwood & Price, 2005). This prompts questions about the role of evidence in scholarly practices with technology. While there are different views about the scholarship of teaching and learning (SoTL) (Draeger & Price, 2011), we align our position with that of Hutchings, Huber and Ciccone (2011): "The scholarship of teaching and learning is, at its core, an approach to teaching that is informed by inquiry and evidence (both one's own, and that of others) about student learning" (p. 3).

Given increasing interest in SoTL and concerns about the effectiveness of the use of technology, it is pertinent to enquire whether evidence informs teachers about its educational effectiveness (Draeger & Price, 2011). We begin by reviewing perspectives of evidence.

What is deemed as evidence?

This has been a matter of debate ranging from positivist medical and natural-science perspectives to more contextualist and realist perspectives (Clegg, 2005; Hammersley, 2003, 2007; Hargreaves, 1997; Oakley, 2001). The former have been used in the United States in the shape of meta-analyses and systematic reviews of quantitative studies to evaluate educational effectiveness (Hattie & Marsh, 1996; Means, Toyama, Murphy, Bakia, & Jones, 2010; Slavin, 2008; Slavin, Lake, Davis, & Madden, 2011; Tamim et al., 2011). This approach is prevalent in the medical profession where research favours positivist experimental methods (see, for example, Kings College London, 2011). These are based upon the notion that evidence is collected from large-scale controlled quantitative experimental studies such as clinical field trials, an approach that is rarely feasible in higher education. Clegg (2005) highlights the limitations associated with this approach as it fails to provide insights about actual practices. She argues that there are important issues that need to taken into account when considering evidence "because the key issues are sociopolitical, and concern fundamental ontological and epistemological assumptions that are not capable of resolution at the level of method" (p. 416).

Oliver and Conole (2003) also raise concerns about approaches to evidence in higher education:

> If the sector is faced with a simple problem concerning the skilled use of technology, then it makes sense to refine systematically the techniques through which technology is applied. However, if teaching and learning is seen as being more complex than the application of technology, this approach becomes problematic (pp. 392-393).

Even in evidence-based medicine, where the explicit use of current best evidence is used in making clinical decisions (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996), it is accepted that qualitative evidence can be more influential in changing practice than scientific publications (Green & Britten, 1998). Hence a range of perspectives as well as methods is required to uncover evidence that can answer difficult questions about human behaviour.

Perspectives about evidence are not just methodological. They may also encompass different views about learning. For example, learning may be characterised as qualitative changes in development where each student develops at different rates (e.g., Marton & Säljö, 2005; Perry, 1970; Säljö, 1979). Or it may be considered more quantitatively in terms of changes in grades, where assumed "exit behaviours" are the same for all students (Elliott, 2001). Hence conceptions of evidence and its subsequent collection are linked with fundamental beliefs about learning and teaching and about the nature of evidence itself. So while the notion of using evidence to support practice may be appealing, it is confounded by often uncritically considered conceptions, claims, rhetoric and practices (Simons, 2003).

Evidence and practice

Higher education practitioners tend not to capitalise on educational research: decision-making tends to be based on personal experiences (Locke, 2009; Scott, 2000; Shattock, 2003; Teichler, 2000). While some have argued that teachers could learn from medical perspectives on evidence-based practices (Hargreaves, 1996, 1997), others argue that this prospect is naive

and crudely positivist (Clegg, 2005; Elliott, 2001; Hammersley, 1997, 2007; Oakley, 2001). Regardless of the nature of evidence there remain tensions about its scholarly use. Kanuka (2011) raises issues about the quality of SoTL and its lack of foundation upon previous research (see also Gibbs, 2010). Two of the four dimensions proposed by Trigwell, Martin, Benjamin & Prosser (2000) in their model of the scholarship of teaching, are useful for considering how evidence is viewed in relation to the scholarly practices of university teachers:

> (a) the extent to which they engage with the scholarly contributions of others, including the literature of teaching and learning of a general nature, and particularly that in their discipline;
> (b) the focus of their reflection on their own teaching practice and the learning of students within the context of their own discipline (p. 163).

Thus conceptions of evidence and its use may reflect contextual differences such as discipline (Donald, 2002; Healey, 2000) as well as epistemological and ontological ones. But to what extent are practitioners in the field aware of these debates and issues? While the use of technology for teaching and learning is now widespread, its educational effectiveness is still open to question. In this study we use three types of enquiry to examine what forms of evidence (if any) are used to inform teachers' practices.

Method

This mixed-method research was conducted within a pragmatist paradigm. It adopted pluralistic approaches to deriving knowledge about problems in real-world practice-oriented situations (Creswell, 2003). Using methodological triangulation enabled a comprehensive examination of the research problem from more than one perspective (Cohen, Manion, & Morrison, 2011; Creswell, 2003). This is important given the issues raised in the literature in relation to varying perspectives on evidence. The benefits of this approach include "increasing confidence in research data, creating innovative ways of understanding a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem" (Thurmond, 2001, p. 254).

If the conclusions from each of the methods are the same, then validity is established. This "sequential mixed-method design" (Cohen et al., 2011, p. 25) comprised a literature review, a short practitioner questionnaire, and interviews with practitioners. Figure 1 illustrates the three stages of the design. This enabled the findings from the literature review and the questionnaires to inform who might be suitable for the proposed interviews. The research questions addressed were:-

- When contemplating using technology for teaching and learning, what do practitioners consider as evidence of enhancement?
- How do practitioners use this evidence in supporting teaching and learning?

Figure 1. Stages of the mixed-method research design.

Stage	Method	Sampling regime	Sample size	Rationale
1	Literature review	Selection of peer-reviewed articles and case studies based on meeting set criteria.	96	To examine how practitioners consider and use evidence as reported in literature artefacts that have been peer reviewed
2	Open-ended questionnaire	Practitioner views elicited through volunteer sampling.	55	To examine what practitioners consider as evidence and how they report using to support their practice. Volunteer sampling is a useful strategy for eliciting views from difficult-to-access groups.
3	Interviews	Purposive sampling based on findings from the literature review (stage 1) and the open-ended questionnaires (stage 2).	8	To examine views in depth about the nature of evidence and its use in supporting practice from practitioners. The sample represented a range of perspectives and experience in relation to the use of technology in learning and teaching.

We also drew interpretations of technology from the literature to address concerns about different terminology being used in different national contexts (Osborne, 2002).

Procedure for the literature review

The literature review encompassed articles, conference papers, reports and case studies in a range of disciplines. It built on a previous study of the use of technology in higher education (Price & Kirkwood, 2011). The peer-reviewed artefacts were international. These were sourced by searching databases using the keywords "technology", "university *or* higher education", "teaching *or* learning" and "evidence *or* empirical". They were confined to the period 2005 to 2010, a timescale considered relevant for the current investigation. The case studies were subject to the same criteria but were United Kingdom (UK) based, as the funder was interested in UK perspectives on the role of evidence to informing practice. For inclusion in the review, artefacts had to report upon technology that had been used for specific teaching and/or learning purposes in higher education. They also had to provide some form of evidence of improvements. Documents that referred to non-tertiary education were excluded, as were those about institutional policies or general attitudes to the use of technology. Literature reviews were also excluded as we wanted to review primary sources. After applying these criteria 96 unique documents were selected for analysis. All the artefacts were read by each author independently and notes were recorded in a table under the following criteria:

- Study/form of evidence
- Teaching and learning intervention

- Subject/discipline & level
- Challenge/aim of teaching and learning intervention
- Number of participants
- Country
- Research/evaluation method(s)
- Key findings

This allowed for an evaluation of each artefact within the rationale, context and methodological approach as described by the original authors. This was in acknowledgement of varying ontological and epistemological perspectives about evidence and about possible differences in terminology use between countries.

Through discussion, agreement was reached about the salient points in each paper. From this table we interpreted the term "technology" in relation to how the authors' themselves construed it within their artefacts as follows:

- Blended learning/e-learning/hybrid courses
- Audio/podcasts
- Video resources/lectures/games
- Multimedia tools
- Virtual laboratories/fieldwork
- Blogs
- Collaborative tools/wikis
- Online discussion boards/conferences/forums
- e-Portfolios
- Online course resources
- Electronic voting/personal response systems
- Assistive technologies

The information in the table was then "qualitized" (Cohen et al., 2011, p. 24): the qualitative literature review was coded into a framework using the information from the initial table. The framework (illustrated in Figure 2) had been developed in collaboration with the funders and with five researchers from two other parallel funded studies. It was designed to acknowledge some of the ontological, epistemological and contextual perspectives of evidence as well as varying methodological approaches. This enabled a wide range of artefacts to be considered. Consideration was given to the evidence presented in relation to the rationale and claims made about improvements in teaching and learning. Our piloting of the framework had involved categorising a sample of artefacts with colleagues from fellow funded synthesis projects into the framework. This indicated that the framework was valuable for assessing evidence with regard to its nature and within the context described in the article. Figure 2 illustrates the framework.

All the artefacts were categorised by each author independently using the framework in Figure 2. Hence changes in practice (evidence category 3) impacting in local classroom contexts would be categorised as 3a, while impact across departments, faculties/institutions

would be 3b, and impact across national or international contexts would be categorised as 3c. Through discussion, agreement was reached about the final categorisation of each article.

Figure 2. Evidence framework.

Type of evidence	**Impact of evidence**		
	a. Micro: These changes are typically a level local; i.e. to the teacher/classroom or a particular module or course.	***b. Meso:*** These changes are typically within a department, faculty or institution and will have impact on more than one module or course.	***c. Macro*:** These changes typically impact on more than one institution at national level and may also have impact internationally (i.e. with institutions or in different countries).
1. Accounts of innovations: These provide descriptions of how technology has been used in teaching and learning. The nature of the evidence is less formal and includes anecdotes, observations and self-report questionnaire data regarding measures of student satisfaction			
2. Lessons learned: These are accounts of teaching and learning with technology and lessons that have been learned from their use. The nature of the evidence ranges from formal to informal forms of data collection, including qualitative and quantitative data, collected by methods ranging from weak to robust.			
3. Changes in practice: These provide good examples of how evidence had been used to drive an investigation into teaching and learning with technology, followed by an evaluation of its effectiveness for student learning. The nature of the evidence is robust in illustrating changes in practice.			

Procedure for the questionnaire

A short open-ended questionnaire was administered online via SurveyMonkey (http://www.surveymonkey.com) using volunteer sampling. This approach is sometimes

inevitable given that access to some groups (in this case, university teachers) is difficult (Cohen et al., 2011; Morrison, 2006). The questionnaire was designed collaboratively with researchers involved in the two parallel funded synthesis projects. It consisting of two closed demographic questions, two open questions about what resources they used and who or what they consulted to support their practices, and one array question ranking the importance/influence of information/experience sources. It was piloted by asking participants in UK seminars on learning and teaching with technology (sponsored by the funders) to complete paper versions. Details of the study were distributed through the higher education sponsored emailing lists (which also have non-UK-based members). In total 55 people volunteered to participate.

Procedure for the practitioner interviews

Purposive sampling (Blaxter, Hughes, & Tight, 2006; Cohen et al., 2011) was used to select participants for interview specifically because they were using technology in their teaching and learning and publishing their findings. They were drawn from the set of authors in the literature review and from the questionnaire respondents. In total eight interviews were conducted comprising four practitioners, one policy maker, two educational developers, and one joint interview with an educational developer and a practitioner. The aim was to elicit views on evidence and its role in teaching and learning with technology.

Findings

Literature analysis

The type of evidence presented in the artefacts was largely "lessons learned" (see Table 1), followed by "accounts of innovations", with a small proportion reporting evidence of changes in practice. The impact of these changes was mainly at a micro (classroom level), with macro (national/international) evidence of change being small. Table 1 illustrates that the most common type of evidence was of a localised nature concerning lessons learned (2a at 35%).

Table 1. Overview of evidence for all documents.

	Impact of Evidence			
Type of Evidence	a. Micro	b. Meso	c. Macro	Total
1. Accounts of innovations	29 (30%)	4 (4%)	1 (1%)	**34** (35%)
2. Lessons learned	34 (35%)	12 (13%)	7 (7%)	**53** (55%)
3. Changes in practice	5 (5%)	3 (3%)	1 (1%)	**9** (9%)
Total	**68** (70%)	**19** (20%)	**9** (9%)	**96** (100%)

We analysed the data further to explore differences between practitioner and researcher foci (Hammersley, 1997; Hargreaves, 1996, 1997), separating the documents into two groups: 54 peer-reviewed documents (see Table 2) and 42 case-study documents (see Table 3).

Table 2. Overview of evidence for peer-reviewed documents group.

Type of Evidence	Impact of Evidence			Total (%) of peer-reviewed artefacts	Percentage of all artefacts
	a. Micro	b. Meso	c. Macro		
1. Accounts of innovations	1 (1%)	1 (1%)	1 (1%)	3 (6%)	3%
2. Lessons learned	30 (31%)	10 (11%)	4 (4%)	44 (81%)	46%
3. Changes in practice	5 (5%)	1 (1%)	1 (1%)	7 (13%)	7%
Total (%) of peer-reviewed artefacts	36 (67%)	12 (22%)	6 (11%)	54 (100%)	
Percentage of all artefacts	38%	13%	6%	54 (56%)	56%

Note: Percentages may not sum exactly to 100% because of rounding errors

Table 3. Overview of evidence for case studies group.

Type of Evidence	Impact of Evidence			Total (%) of case studies	Percentage of all artefacts
	a. Micro	b. Meso	c. Macro		
1. Accounts of innovations	28 (29%)	3 (3%)	0	31 (74%)	32%
2. Lessons learned	4 (4%)	2 (2%)	3 (3%)	9 (21%)	9%
3. Changes in practice	0	2 (2%)	0	2 (5%)	2%
Total (%) of case studies	32 (67%)	7 (22%)	3 (11%)	42 (100%)	
Percentage of all artefacts	33%	7%	3%	42 (44%)	44%

Note: Percentages may not sum exactly to 100% because of rounding errors

The peer-reviewed group had a larger percentage than the case-study group of documents that reported "lessons learned". The difference was reversed when considering "accounts of innovations" as an evidence type. For both groups evidence categorised as "changes in practice" was small and the difference slight. Additionally the bulk of the evidence was also at a local (micro) level. These findings suggest differences in the nature of the evidence

reported: case-studies tended to report evidence in terms of "accounts of innovations", while the peer-reviewed artefacts reported evidence of "lessons learned".

In terms of the overall quality of the artefacts, peer-reviewed documents tended to make better reference to existing evidence and provided better explanations of the evidence gathering process. However, overall there were gaps in what the documents reported, the most significant being a clear explanation of the context within which the study occurred and evidence of impact on student learning. This is important for determining what can be generalised from one context to another (Thorpe, 2008). Our observations of the gaps are summarised as follows:

- *Inception.* In many of the studies there was no indication of the rationale. Few examined the educational problems that their students were encountering. Although most included a literature review, limited use was made of this in framing the research questions *before* introducing technology.
- *Evidence sought.* In some of the studies the research design was not robust, and hence other variables could have been associated with any improvements achieved. Many of the studies relied upon self-reporting by students or teachers of perceptions and attitudes to technology as the main method of data collection, thus making judgements about educational effectiveness difficult.
- *Outcomes.* In several studies the main finding was that the technology had increased the flexibility for students. While this might reflect operational goals, it reveals little about improving student learning. In only a few cases were the findings shown to have led to changes in practice.

Practitioners' questionnaire analysis

Of the 55 respondents, three-quarters were teachers: the rest comprised professional developers, learning technologists and others with links to learning and teaching with technology. Content analysis was adopted, and analytic coding (Cohen et al., 2011) was used to assign categories to the free-text answers in the open questions. Of the 41 people who responded to the question about sources of guidance, four-fifths (33) indicated that two or more sources of guidance were consulted (presented in descending order of mentions in Table 4).

Respondents were presented with a list of nine ways in which they might learn about teaching and learning with technology. They were invited to rate each item on a 5-point scale, from "very influential" (5) to "no influence" (1) (see Table 5). Sharing information with colleagues, spontaneous learning in the workplace and informal workplace discussions were chosen as being highly influential sources. While regular reading of relevant journals was considered important, it lagged behind personal contact. Formal training methods (e.g., technical training, internal courses, conferences, etc.) were considered to be less influential than informal/social means (e.g., sharing knowledge with colleagues, informal discussions, spontaneous learning). In other words, respondents were more likely to be influenced by direct contact with colleagues and by experience of engaging with relevant work or personal activities.

Table 4. Sources of guidance consulted by respondents to the online survey.

Category	*n* (%)
Institution's Centre for Academic Development / Teaching Development / e-Learning	36 (40%)
Academic colleagues	23 (25%)
Departmental advisers for educational development / e-Learning, etc.	11 (12%)
Colleagues with experience of using technologies for teaching and learning	6 (7%)
Senior staff within own department or faculty	5 (5%)
Technical or specialist advisers	4 (5%)
Students	3 (3%)
"Self" or "no one"	3 (3%)
Total number of mentions	91 (100%)

Table 5. Perceived influence of various sources on teaching practice.

Source	Rating average
Technical training (e.g., courses in how to use technologies)	3.38
Internal training courses	3.23
Acquiring generic skills/competencies related to job	3.65
Regular reading of relevant journals and books	3.46
Acquiring knowledge through browsing websites or "surfing the net"	3.74
Attending conferences, symposia and/or workshops	3.59
Learning through informal discussions in the workplace	4.10
Spontaneous learning arising from work or personal activities	4.31
Sharing knowledge with colleagues	4.35

Note: "Ratings varied from 1 (no influence) to 5 (very influential)"?

Participants were asked to make recommendations about particular resources or evidence they used to support their practice. The bulk of these might be described as "grey literature". Considerable emphasis was placed on pedagogical books with only two of these being

subject specific. Less use was made of journal articles. So although participants felt that reading relevant journals was influential, very few made recommendations about specific journals. This could suggest that while journals are believed to be useful, in practice specific journals that publish about teaching and learning with technology are not widely used or even known.

Interview analysis

Inductive thematic analysis was used as a technique for analysing the data (Braun & Clarke, 2006). This form of analysis has some similarities with grounded theory in that the themes are typically data-driven. After becoming familiar with the data a number of themes were identified by coding small chunks of data with brief descriptions. This was an iterative process and the themes were developed as new data were analysed. This process continued until a good fit was found between a substantive set of the coded data and the themes. The themes that emerged are illustrated in Table 6 and indicate some of the issues surrounding evidence and its use in driving teaching practices with technology.

Table 6. Themes that emerged from the interviews.

Themes	Description of theme
Nature of evidence and its collection	Defining evidence of an improvement in student learning when using technology was difficult and complex. Views included increased engagement, improved learning experience, integrating theory and practice, and qualitative (transformational) changes such as conceiving and thinking differently. Practitioners were not focused on quantitative changes in learning as they felt that these often masked richer changes in learning not easily assessed. There was uniformity in the view that collecting appropriate evidence was difficult. It was not that the collection process itself was problematic – but collecting evidence that demonstrated an impact (usually qualitative) was challenging.
Use of evidence	This was a problematic issue and one that was not dealt with systematically. Knowing what others had done was difficult and finding out was often via networking with colleagues both within their own institution and in other institutions. While some did use journal articles and accounts of practice this was somewhat haphazard and often within specific discipline areas. Few used evidence from a range of sources. In some instances the reviewing of existing evidence was mediated through educational development specialists. Others used available technologies in order to help students achieve educational outcomes that were important in their particular contexts. Many innovative uses tended not to be formally reported through articles or case studies. For educational developers and policy makers, however, the use of evidence played an important role in influencing developments.
Generating and sharing own evidence	There was a greater tendency to produce evidence than to use existing evidence to drive innovations and/or changes in practice. Dissemination varied among interviewees. Practitioners tended to disseminate primarily to colleagues within their own institution. Those engaged with educational developments tended to seek to disseminate more widely.
Changes in practice	Changing practice is quite difficult as beliefs and approaches to teaching and learning are deeply embedded. Making changes to teaching often began with looking at the students' needs as opposed to using evidence that others had gathered and reported upon. Using technology was a catalyst for reflecting upon how students would engage in learning and the sequence of activities in learning. However, finding the time and the funding to make significant changes that used technology was challenging and practitioners needed to have confidence in their use of technology before beginning. Hence innovations were often of the 'lone ranger' type by committed individuals in pockets in different areas: institutionalising changes and disseminating evidence about good practice is challenging.

The following extracts from the interviews exemplify some of the themes in Table 6. The participants are referred to as P1 to P8.

The notion of evidence was a uniformly difficult concept for participants to articulate and gathering evidence was also reported as complex.

P8 OK… that's a hard question to answer… em… OK… em…. I think there are two sorts of evidence… obviously there is good old fashioned scientific quantitative evidence… the sort of thing we demonstrate through server logs…. exam performance…. that sort of thing… its always been incredibly difficult to relate that sort of quantitative evidence back to any kind of educational intervention….. perhaps more realistically the evidence of effectiveness is qualitative rather than quantitative….. so it's the sorts of things that students say….and the responses that you get from students….

P7 [Evidencing] transformation in learning is incredibly difficult…. And again it comes back to the interlinking of the pedagogies, technologies and organisational issues…. Even getting teachers to change their practice a little bit is really hard…. because as teachers we all have very embedded notions that are built on years of practice.

The use of existing evidence did not feature foremost in developing innovations with technology. More often, participants spoke about the student learning needs and the generation of their own evidence that the innovation worked.

P5 I think you should start with the student's learning needs first…. And then look at how the technology supports your learning….

One interviewee argued that we should not wait for evidence:

P4 I don't think we need evidence… there's a saying… it doesn't take a whole day to recognise sunshine… you can see when something's good…. you should be using it…. if you wait for the evidence to come… you're kinda behind the times…

Others were concerned about having a variety of forms of evidence fearing that this variation was dependent upon the contexts and the needs to answer the question within that context.

P3 The role of evidence is very important…. its also hard to get….in an area where you are dealing with a wide range of people with an enormous amount of skills…. you've really got to work hard to understand the pedagogical impact of any media....

The academic developer's role was also key in supporting the interpretation of evidence.

P2 For me having [the academic developer] in the team who is able to do this process of uncalled amplification…. filtering of examples… good case studies…. that sort of thing that then says… I wonder if that would work in my context….or I wonder if I could get my students to do that.

Innovations with technology tended to be initiated by committed individuals in institutions who were typically confident with the technology. Those acting as "lone rangers" seemed to be content to look for evidence of how well their own attempts had enhanced teaching and learning practices.

> P7 I don't know if we have quite got past the lone ranger effect…..essentially what most people are doing…is…. the advances that are being made are being made by committed individuals… and when you try to institutionalise those advances….. then you run into the big problems.

Triangulation between the data sources

The three sources of data all confirm that evidence is under-used to support teaching and learning practices with technology. The questionnaires and the interviews provided more insight into this. Both confirmed that practitioners preferred to confer with colleagues about exploiting technology rather than to engage with the literature for guidance. All three studies also confirmed that there are ontological and epistemological variations in practitioners' views. The literature review illustrated this through the ways in which evidence was conceived and reported. The questionnaires illustrated this through the use of grey literature rather than more robust studies and the interviews further confirmed participants' expressed differences in evidence and its collection.

Discussion

The three sources of data allowed us to examine what authors reported as evidence and how they had used this evidence in their practice. Limited use was made of evidence derived from the literature in framing the research question and in analysing the findings. Case study articles tended to report 'accounts of practice' while peer-reviewed journal articles tended to report "lessons learned". This may suggest that teachers are more concerned about "what works" while researchers are more concerned about "why it works" (Hargreaves, 1997, p. 410). It may also reflect tensions between the objectivity and autonomy of educational research in higher education given the multiple identities of an academic as a practitioner and a researcher (Andresen, 2000; Brennan, 2007). Different ontological and epistemological perspectives about evidence may be a contributing factor (Clegg, 2005). Given that judgements about these studies were made within the terms of reference of the studies that the authors described, we have, as far as possible, taken account of different perspectives on evidence. Nonetheless, there are still underlying issues about what constitutes evidence and concomitant contextual variations (Gorard & Selwyn, 2005).

The findings from the questionnaire survey also highlighted the limited use of evidence drawn from the literature to support teaching practices. This confirms the findings of our literature review. Practitioners preferred to consult an academic developer or colleagues for guidance, rather than reading journal articles. While practitioners reported that reading journals was important, few journals were specifically mentioned when they were asked what they used to support their practice. This might suggest a dissonance between beliefs and intentions in the use of technology for teaching and learning. This kind of

dissonance has been observed by Norton, Richardson, Hartley, Newstead, & Mayes (2005) in their study of 638 higher education teachers' beliefs and intentions regarding teaching.

The interviewees were drawn from questionnaire participants and authors of some of the studies in order to support the triangulation process. This data confirmed the findings from the literature analysis in that evidence was having limited impact on changing practice. The interviews illuminated some of the issues uncovered in the literature analysis. First, they highlighted differences on perspectives of evidence. One participant did not considering it necessary to wait for evidence before using technology with students. Others talked about starting with student needs, but few mentioned referring to previous studies in order to determine which teaching interventions with technology would be worthwhile. Second, they illustrated the role that academic developers have in mediating evidence for practitioners. A fundamental issue was the difficulty in articulating what could be presented as evidence of educational effectiveness. This was a uniformly held view. Improvements were considered to be transformations of some kind for the learner, rarely captured by quantitative measures. The interviews also confirmed the finding of our literature review that more effort was expended carrying out new investigations than using existing evidence to drive change.

Undertaking a study of this kind is difficult in terms of sampling and gaining access to practitioners in a wide range of contexts. Independently, each of the three parts of the studies might be criticised, to some degree, for their subjectivity in the categorisation used in the literature analysis, and the sampling methods in the survey and interviews. However the pragmatist paradigm adopted in this mixed-methods approach enabled an examination of the research questions from a number of perspectives, where the results show similar findings. The combination and triangulation of the three sources of data foreground some important implications for the role of evidence in teaching and learning with technology. We have shown in previous reviews that evidence is under-utilised in developing learning and teaching practices with technology in national contexts (Kirkwood & Price, 2005).

We conclude that evidence has only a partial influence upon informing practice. The findings suggest inherent problems in examining the role of evidence in teaching and learning practices with technology, not least in understanding what constitutes evidence, the role of evidence and for whom it is intended. This complexity needs to be acknowledged in any conclusions drawn about the use of evidence in informing and driving changes in practice in teaching and learning with technology in higher education.

Acknowledgements

We would like to thank the United Kingdom Higher Education Academy for funding this project and John Richardson for reading and commenting on drafts of this manuscript.

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