Missing: Evidence of a scholarly approach to teaching and learning with technology in higher education

Adrian Kirkwood and Linda Price

Institute of Educational Technology, The Open University, Milton Keynes, UK

Address for correspondence: Adrian Kirkwood a.t.kirkwood@open.ac.uk

Abstract:

As technology is increasingly being used for teaching and learning in higher education, it is important to scrutinise what tangible educational gains are being attained. Are claims about technology transforming learning and teaching in higher education borne out by actual practices? This paper draws upon a critical analysis of recent research literature concerning Technology Enhanced Learning (TEL). It argues that few published accounts of TEL practices show evidence of a scholarly approach to university teaching. Frequently, TEL interventions appear to be technology-led rather than responding to identified teaching and learning issues. The crucial role of teachers' differing conceptions of teaching and of the purpose of professional development activities is often ignored. We argue that developing a more scholarly approach among university teachers is more essential than providing technical training if practices are to be improved to maximise the effectiveness of TEL.

Keywords:

Technology enhanced learning; student learning; teaching in higher education; scholarship of teaching and learning; technological determinism.

Introduction

In recent years the Higher Education sector has made considerable investments in equipment and infrastructure to support learning and teaching and most western universities now have some form of virtual/managed learning environment. The 2010 Universities and Colleges Information Systems Association survey of Technology Enhanced Learning (TEL) for higher education in the UK found that "Enhancing the quality of learning and teaching is … the primary driver for considering using TEL" (Browne *et al*, 2010, p. 8). Teachers, educational developers and technical support staff have expended considerable time and effort in trying to derive benefits from using technology to enhance student learning. However, the benefits for teachers and learners remain ambiguous and contested and it is difficult to find consensus in answer to questions such as:

- What impact is technology having upon the processes of teaching and learning in higher education?

- Who or what is considered to be the agent of any changes that are occurring in teaching practices?

- What is the role of professional development activities in supporting teaching with technology?

- Are teachers (and policy-makers) adopting a scholarly approach to the adoption of technology for educational purposes?

In this essay we reflect upon the many articles, reports, surveys, presentations and case studies that we have encountered in recent years concerning actual instantiations of technology use in university teaching and learning. Particular consideration will be given to a recent review of literature and case studies (Price and Kirkwood, 2011). In the process we hope to provide some tentative answers to the questions listed above.

Differing conceptions of and approaches to teaching in HE

There are consistent findings from research conducted in several countries pertaining to variations among university teachers in terms of what they believe 'teaching' to be about (Kember & Kwan, 2000; Samuelowicz & Bain, 1992 & 2001; Trigwell & Prosser, 1996). While some have *teaching-focused* conceptions, with teaching being

considered to be primarily about the transmission of information, skills and attitudes to students, other teachers have *learning-focused* conceptions that give primacy to promoting the development of conceptual understanding in students. The same research has also demonstrated that the conceptions of teaching held by HE teachers are related to how they approach their teaching. So, teachers whose conception of teaching foregrounds 'the transmission of knowledge' are likely to adopt a teacher-centred approach and be concerned with refining and developing their own skills and strategies. In contrast, if teaching is conceived as being about 'promoting conceptual development in learners', then a learner-centred approach is likely to be adopted, in which the students and their learning and development are the focus of teaching activities. Further, the *approach to teaching* of individual teachers has been found to be related to both the *assessment practices* they adopt (Samuelowicz & Bain, 2002) and the *approach to learning* exhibited by their students (Lindblom-Ylänne, Trigwell, Nevgi & Ashwin, 2006; Trigwell, Prosser & Waterhouse, 1999). It has also been found that a teacher's conception of teaching is related to their expectations of professional development activities and could potentially constrain their development as a teacher (Åkerlind, 2003, 2007). We return to this issue in a subsequent section.

These variations in teachers' conceptions of and approaches to teaching can help us to understand differences in the ways in which technology is used for university teaching. It helps explain differences in technology use at both the strategic (i.e. general approach) and tactical (i.e. particular applications) levels. In strategic terms, individuals whose conception is teaching-focused are more likely to use technology in ways that support existing transmissive teaching strategies. Presentational forms (e.g. PowerPoint shows, podcasts of lectures, webcasts, etc.) buttress the practices of teaching-centred teachers. Also, it could be argued that those with a teaching-focused conception would favour use technology to replicate or supplement their existing teaching practices.

In contrast, individuals with a learning-focused conception of teaching are more likely to exploit technologies and tools that facilitate and support the learning and development of their students. Such teachers propose the use of tools that enable students to interrogate sources of information or data, to undertake group tasks, or to reflect upon and demonstrate developments in their understanding and practices (using wikis, blogs, discussion forums, portfolios, etc.). Often these would be associated with attempts to transform the learning experience through active engagement in knowledge

building and sharing, and reflection upon learning and development episodes and processes.

In terms of tactical approaches to technology use, variations in conceptions of teaching can account for the different ways in which a particular technology or tool can be utilised (e.g. discussion forums, podcasts, wikis, etc.).

Table 1 illustrates how we theorise the relationship between conceptions of teaching, approaches to teaching, and approaches to teaching and learning with technology.

Table 1 about here

What do we mean by a 'scholarly approach'?

We do not wish to debate the meaning of 'scholarship' at length here. However, we feel that this succinct statement (Hutchins, Huber and Ciccone, 2011, p. 3) captures many key points for our discussion:

> 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. In this sense, it is not so much a function of what particular pedagogies [teachers] use. Rather, it concerns the thoughtfulness with which they construct the learning environments they offer students, the attention they pay to students and their learning, and the engagement they seek with colleagues on all things pertaining to education in their disciplines, programs, and institutions [*emphasis added*].

In a recent literature review of accounts of the use of technology for teaching and learning in higher education (Price and Kirkwood, 2011) we looked for indications of a scholarly approach having been applied. Peer-reviewed articles in the research literature and case studies published on the HEA *EvidenceNet* and JISC *Infonet* websites during the period from 2005 to 2010 were examined. To be included within the review, documents had to report upon an actual application of technology for teaching and/or learning purposes in higher education. The journal articles were all written in English, but referred to TEL projects in many different countries. All the documents that were

reviewed had to provide some form of evidence of the impact of the innovation or intervention. When examining the literature the following aspects were considered:

- What evidence was being used to drive the innovation/intervention?
- What evidence was gathered?
- What evidence illustrates changes in the professional practice of teachers in higher education?

To explore the issues further, we related accounts of TEL innovations or interventions to one particular model of the scholarship of teaching (Trigwell, Martin, Benjamin & Prosser, 2000). We found the four dimensions they propose (p. 163) to be useful for our purpose:

> The extent to which a teacher is engaging in the scholarship of teaching might … be described in terms of these four dimensions as follows:
> (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: whether it is unfocussed, or whether it is asking what do I need to know and how do I find out;
> (c) the quality of the communication and dissemination of aspects of practice and theoretical ideas about teaching and learning in general, and teaching and learning within their discipline; and
> (d) their conceptions of teaching and learning: whether the focus of their activities is on student learning and teaching or mainly on teaching.

In the following sub-sections we reflect on the process and findings of that review in relation to the dimensions portrayed by Trigwell *et al* (2000).

a) Engaging with the scholarly contributions of others

Although published studies include a review of the relevant existing literature, in many of the reviewed documents there was no indication that findings or evidence from relevant previous studies were considered *before* introducing their innovation or that it had contributed to the framing of research questions. Few of the online case studies referred to relevant findings from the literature or lessons learned from previous studies.

Any evidence that was drawn upon tended to be from published accounts of using the particular technology that the teacher/researcher had selected to employ in their own study. Such evidence was more likely to highlight the *general and potential ways* in which that technology or tool could benefit learning and teaching, rather than to any evidence of actual learning gains achieved by analogous students in comparable contexts.

b) Reflection on their own teaching practice and the learning of students within the context of their own discipline

More often than not technology was used to address an under-defined issue. In many of the articles and case studies there was no explicit statement of the rationale, i.e. what had prompted the innovation, other than a desire to experiment with a particular technology or tool. Few accounts described a teaching or learning issue that needed to be addressed and hardly any examined educational problems or opportunities that their particular students were facing. Where other studies were cited, there was seldom any consideration of the extent to which contextual factors (discipline, level, student characteristics, etc.) were appropriately matched to the teacher's/researcher's own circumstances. Often there was no clear articulation of what was considered to constitute an 'enhancement' (to teaching, to learning or to the learning experience), so that it was difficult to know precisely what was being sought and to identify whether or not a satisfactory outcome had been achieved.

c) Communication and dissemination of aspects of practice and theoretical ideas about teaching and learning in general

As the review was of published documents, the teachers/researchers had clearly been keen to disseminate the outcomes of their studies. However, it would be difficult to generalise the findings of many of the studies to any other context due to the manner in which the accounts were reported. Often the focus of a TEL innovation or intervention had been on a fairly specific application of a technology (e.g. blogs, podcasts, wikis, etc.), although there are often many ways in which a particular technology can be used for different educational purposes and can vary considerably between contexts. Published reports often provided insufficient contextual detail and the educational design of what had actually been studied was considerably more complex than what is reported (Thorpe, 2008).

d) Conceptions of teaching and learning

Few of the studies reviewed contained explicit statements about how *teaching* and *learning* had been conceptualised and reference to relevant theoretical ideas or models was uncommon. Many of the TEL innovations aimed to replicate or supplement existing teaching practices without any discussion of the appropriateness of that current approach. It was rare to find any acknowledgement of the potential influence of assessment upon what students actually did. One way of discerning the conception of learning implicit within a study was by considering the types of evidence collected. Most of the TEL projects that sought to replicate or supplement existing teaching practices employed test or course assignment scores to evidence learning gains. That is, a learning enhancement was interpreted as a *quantitative* change. A relatively small number of TEL projects were explicitly concerned with fostering *qualitative* improvements in student learning.

In terms of the model proposed by Trigwell, *et al* (2000), we suggest that relatively few of the documents reviewed exhibited an approach to teaching that could be considered *scholarly*. So, what are the factors that are driving the use of technology in higher education teaching and what purposes are being served by the massive growth in computer-based systems?

A technology-led focus on teaching and learning?

Among practitioners there does not appear to be a widely shared view of what constitutes *enhanced learning* in higher education and how it can be achieved. Strategy and policy documents often provide little in the way of illumination. For example, the HEFCE revised e-learning strategy (HEFCE, 2009) mentions 'enhancing learning and teaching through the use of technology' and indicated that there should be an increased focus on *student learning* in institutional approaches. However, the document provides little clarification to illustrate what types of activity it envisages the term to embrace. The 2009 document *Effective Practice in a Digital Age* from the UK's Joint Information Systems Committee (JISC) states that "Effective practice can be defined as employing a range of pedagogic skills to bring about the best possible learning for the widest variety of learners" (p. 8). It suggests that technology adds value to learning by enabling a range of 11 features, the majority of which could be described as 'operational' (e.g. providing better accessibility and flexibility for learners; access to resources and

connectivity with others). However, the effects upon what and how students learn as a consequence of these operational changes are not discussed (e.g. access to resources and connectivity for what purposes?). We share the concerns expressed by Goodfellow and Lea (2007) about policies and strategies relating to TEL at national and institutional levels being focused on managing learning through systems and processes, rather than on how learners can benefit from widening means of engagement with disciplinary and subject-based knowledge.

The lack of precision and clarity about the application of technology to educational processes suggests that technology-led conceptions are predominant among higher education teachers in the design and implementation of new forms of academic practice. We are concerned that a large proportion of the published accounts of TEL activities in higher education exhibit a technology-led focus on teaching and learning (discussed at greater length in Kirkwood and Price, 2012). They concentrate too much on technology (rather than teaching and/or learning) as the *object* of attention and as the *agent* of change.

With the sources that we have mainly used (published accounts), we cannot say that those designing and evaluating the innovations or interventions did not take 'scholarly' factors and student learning issues into consideration. However, if they were considered, they clearly were not felt to be sufficiently significant to communicate to the audience of practitioner and researcher peers. Very often teachers seem to be asking "What can I use this technology or tool for?" rather than "How can I enable my students to achieve the desired or necessary learning outcomes?" or "What forms of participation or practice are enabled for learning?"

Just as the content of a book can take many different forms and can be used in a variety of ways for various purposes, so too can most technologies and digital tools support varying patterns of use and activity types. For example, in educational contexts a blog might be used by individual students for their reflections on topics of interest or on their personal and educational development. However, the same tool could just as easily be used as a resource for sharing ideas among all the students taking a module. If a teacher uses PowerPoint or a video-enhanced podcast to deliver a lecture, it does not make it anything other than a lecture. Technology might make the lecture accessible to learners 'any time, anywhere', but does not change it into something different. In any

educational context, the technology is secondary to the main object of attention, i.e. the educational purpose and activity that is being enabled or supported.

Unfortunately, it is not uncommon to find expressions of *technology as agent* in the research literature. For example, a survey of teaching staff in a North American university (Ajjan & Hartshorne, 2008, p. 79) was reported to have found that most teachers

> feel that integrating Web 2.0 technologies such as blogs and wikis into the classroom learning environment can be effective at increasing students' satisfaction with the course, improve their learning and their writing ability, and increase student interaction with other students and [teaching staff]; thus changing the students' role from passive to active learners, allowing them to better create and retain knowledge.

This exemplifies a technological deterministic conception of the educational process – that is, the idea that technological developments are the central determinants of social change rather than social contexts shaping the ways in which technological tools are used. It fails to appreciate the professional role of the academic teacher – the real *agent* – as creator and designer of educational activities that promote the development of learning. Technological determinism endorses the notion that using technology for teaching will *in and of itself* lead to enhanced or transformed educational practices. However, TEL projects that put technology first often result in disappointment for both teachers and their students (Kirkwood, 2009).

With the multiple demands that are made upon university teachers, it is understandable that they might pay insufficient attention to the findings from existing research literature about teaching and learning with technology. However, by seriously considering what educational purposes they are trying to achieve with technology and discovering what existing research and evaluation is relevant and appropriate, teachers might attain greater reward for their efforts.

Transforming university teaching and learning?

Some years ago we argued that technology-led innovations do not in themselves lead to improved educational practices (Kirkwood and Price, 2005). We drew upon reviews conducted in a number of developed countries over numerous decades. We suggested

that too often technologies had been introduced to university teaching with little or no consideration being given to the implications for student learning. Despite much talk about the potential of technology to transform teaching and learning in higher education, very often the reality is different with much university teaching remaining fundamentally unchanged:

> For the most part, faculty who make e-learning a part of their teaching do so by having electronics simplify tasks, not by fundamentally changing how the subject is taught. Lecture notes are readily translated into PowerPoint presentations. Course management tools … are used to distribute course materials, grades and assignments – but the course materials … and the assignments neither look nor feel different. (Zemsky and Massy, 2004, pp. 52-53)

There appears to be some confusion between (a) effecting changes in the *means* through which university teaching happens, and (b) instigating changes in *how* university teachers teach and learners learn. While we have found many examples of the first type of change; there are far fewer cases of the second.

In the literature, it is unusual to come across accounts of *transformations* of teaching practices: what is more commonly found is that technology is used to *replicate* or *supplement* traditional activities (e.g. Blin & Munro, 2008; Gonzalez, 2009; Roberts, 2003). In the recent review referred to earlier (Price and Kirkwood, 2011) only a minority of projects reported in the literature or as online case studies could be characterised as focusing on transforming the learning experience. Those projects usually involved not only the development of TEL resources, but also extensive and structural curriculum changes in the redesign of modules. While technology was involved, it is difficult to estimate the extent to which any enhancement achieved by the redesigned teaching and learning activities was the product of changes in the syllabus and learning design rather than the application of technology as such. Causality is difficult to attribute when several factors have been modified.

Typically, interventions that seek transformative outcomes need to draw upon a range of data sources and the forms of evidence that are collected must be richer than test scores and self-report student satisfaction surveys. Use of a range of data sources enables the triangulation of evidence: it also acknowledges that many interrelated factors influence

student learning. It is not only difficult to bring about improvements in student learning within 'real' contexts, it is even more problematic to demonstrate what has been achieved and how it has occurred (Price and Richardson, 2004).

Drivers for using technology in higher education

Some of the lack of clarity that we have observed might be attributed to the wide variety of purposes that technology is expected to serve, given the range of different factors presented as drivers for increased use of technologies in higher education. These include such things as costs (usually related to growth in student numbers), increased accessibility and flexibility, meeting students' expectations, responding to strategic changes (at national or institutional levels), enhancing learning and transforming learning and teaching.

Professional development for teaching in higher education

To senior managers and policy makers, it seems that enabling academic staff to make appropriate use of technology for teaching and learning is considered to be a technical matter. After raising teachers' awareness about the possibilities offered by new technologies and tools, technical assistance might be necessary to get them up to speed in adopting new practices. Professional development activities are more likely to be concerned with 'how to' issues rather than with explorations of 'why?' or 'for what purpose or goal?' (Price & Kirkwood, 2008). As pedagogical issues and models of learning are infrequently addressed in an explicit manner, the validity and appropriateness of such a technical focus has been questioned (e.g. Benson & Brack, 2009; Oliver & Conole, 2003). If the adequacy of existing beliefs and practices remain unchallenged, technology is unlikely to be used in ways that are not consistent with and supportive of a teacher's current ways of teaching.

A superficial examination of the problem might lead one to believe that it is simply a matter of putting the cart before the horse, i.e. technology before pedagogy. But a deeper examination of the problem shows that even if pedagogic issues are considered first, the adoption of technology might make little difference to student outcomes if teaching is not reconceptualised in relation to TEL. More fundamental issues are related to beliefs about teaching and whether the teacher is engaged in passing on information or transforming a learner.

We mentioned earlier that a teacher's conception of teaching can influence their expectations of and engagement with professional development activities. Nicholls (2005, p. 621) reported that in her study of new university lecturers

> Those who associated teaching with the transmission of knowledge, where students had to acquire a well-defined body of knowledge, were most anxious to develop more sophisticated skills to facilitate the transmission. Those who associated teaching with facilitating learning were anxious to understand and conceptualize the learning process, to help their students.

Transmissive teaching beliefs permeate the sector and often determine the teaching context. Even the most reformed and innovative teacher can be constrained by the departmental or institutional context (Hockings, 2005; Pickering, 2006). This is often evident in professional development programmes that institutions adopt that focus primarily on teaching 'how to' approaches with technologies as opposed to engaging activities that support teachers to reflect on and reconsider heir deeply held beliefs about teaching.

Conclusion

The term TEL is frequently used in an unconsidered manner and many of the published accounts of projects lack a scholarly approach to enhancing teaching and learning. While technology has increasing influence throughout higher education, there is still much to be learned about its effective educational contribution. Fundamental to a scholarly approach to using technology is that it should be informed by inquiry and evidence, but that these relate to the nature of teaching and learning, not just to specific technology applications. Transforming learning is a complex activity. It requires sophisticated reasoning about the goals and purpose of any intervention, the design of the evaluation and the interpretation of the results within the particular educational context.

Too often what is missing is an appreciation that teachers' underlying conceptions of teaching influence their general approach to teaching and their more specific approach to using technology. At the heart of developing the professional practice of academics in using technology is not the necessity to make them more technologically competent. Instead, it is the need for teachers to reconsider the appropriateness of their conceptions

of teaching and their more general approaches to teaching. While we value the contribution of technology to supporting student learning, we strongly contend that technology itself is not the agent of change: it is the teacher.

References

Ajjan, H., and Hartshorne, R. 2008. Investigating faculty decisions to adopt Web 2.0 technologies: theory and empirical tests. *Internet and Higher Education*, 11, no. 1: 71-80.

Åkerlind, G. S. 2003. Growing and developing as a university teacher – variation in meaning, *Studies in Higher Education*, 28, no. 4: 375-390.

Åkerlind, G. S. 2007. Constraints on academics' potential for developing as a teacher, *Studies in Higher Education*, 32, no. 1: 21-37.

Benson, R. and Brack, C. 2009. Developing the scholarship of teaching: what is the role of e-teaching and learning? *Teaching in Higher Education*, 14, no. 1: 71-80.

Blin, F. and Munro, M. 2008. Why hasn't technology disrupted academics' teaching practices? Understanding resistance to change through the lens of activity theory, *Computers and Education*, 50, no. 2: 475-490.

Browne, T., R. Hewitt, M. Jenkins, J. Voce, R. Walker, and H. Yip. 2010. *2010 Survey of Technology Enhanced Learning for higher education in the UK*, Oxford: Universities and Colleges Information Systems Association. http://www.ucisa.ac.uk/groups/ssg/~/media/groups/ssg/surveys/TEL%20survey%202010_FINAL.ashx (accessed 17 April 2012).

Gibbs, G. and Coffey, M. 2004. The impact of training of university teachers on their teaching skills, their approach to teaching and the approach to learning of their students. *Active Learning in Higher Education*, 5, no. 1: 87-100.

Goodfellow, R. and Lea, M. R. 2007. *Challenging e-learning in the university. A literacies perspective*. Maidenhead: Society for Research into Higher Education and Open University Press.

Gonzalez, C. 2009. Conceptions of, and approaches to, teaching online: a study of lecturers teaching postgraduate distance courses. *Higher Education*, 57, no. 3: 299-314.

Higher Education Funding Council for England (2009). *Enhancing learning and teaching through the use of technology: A revised approach to HEFCE's strategy for e-learning*. Bristol: Higher Education Funding Council for England. http://www.hefce.ac.uk/pubs/hefce/2009/09_12/09_12.pdf (accessed 17 April 2012).

Hockings, C. 2005. Removing the barriers? A study of the conditions affecting teaching innovation. *Teaching in Higher Education*, 10, no. 3: 313-326.

Hutchins, P., M.T. Huber, and A. Ciccone. 2011. Getting there: an integrative vision of the scholarship of teaching and learning. *International Journal for of the Scholarship of Teaching and Learning*, 5, no. 1. Available at: http://academics.georgiasouthern.edu/ijsotl/v5n1/featured_essay/PDFs/_Hutchings HuberCiccone.pdf (accessed 17 April 2012).

Joint Information Systems Council (JISC) 2009. *Effective practice in a digital age*. Bristol: JISC. http://www.jisc.ac.uk/whatwedo/programmes/elearningpedagogy/practice.aspx (accessed 17 April 2012).

Kember, D. and Kwan, K-P. 2000. Lecturers' approaches to teaching and their relationship to conceptions of good teaching. *Instructional Science*, 28, no. 5: 469-490.

Kirkwood, A. 2009. E-learning: you don't always get what you hope for, *Technology, Pedagogy and Education*, 18, no. 2: 107-121.

Kirkwood, A. and Price, L. 2005. Learners and learning in the 21st Century: What do we know about students' attitudes and experiences of ICT that will help us design courses? *Studies in Higher Education*, 30, no. 3: 257-274.

Kirkwood, A. and Price, L. 2012. The influence upon design of differing conceptions of teaching and learning with technology. In *Informed Design of Educational*

Technologies in Higher Education: Enhanced Learning and Teaching (eds. A. D. Olofsson & O. Lindberg), 1-20. Hershey, Pennsylvania: IGI Global.

Lindblom-Ylänne, S., K. Trigwell, A. Nevgi, and P. Ashwin. 2006. How approaches to teaching are affected by discipline and teaching context, *Studies in Higher Education*, 31, no. 3: 285-298.

Nicholls, G. 2005. New lecturers' constructions of learning, teaching and research in higher education, *Studies in Higher Education*, 30, no. 5: 611-625.

Oliver, M. and Conole, G. 2003. Evidence-based practice and e-learning in higher education: can we and should we? *Research Papers in Education*, 18: 385-397.

Pickering, A. M. 2006. Learning about university teaching: reflections on a research study investigating influences for change, *Teaching in Higher Education*, 11: 319-335.

Price, L. and Kirkwood, A. 2008. Technology in the United Kingdom's higher education context. In *The Globalised University: Trends and Challenges in Teaching and Learning* (eds. S. Scott & K. C. Dixon), 83-113. Perth: Black Swan Press.

Price, L. and Kirkwood, A. 2011. Enhancing professional learning and teaching through technology: A synthesis of evidence-based practice among teachers in higher education. York: Higher Education Academy.

Price, L. & Richardson, J. T. E. 2004. Why is it difficult to improve student learning? In *Improving Student Learning: Theory, Research and Scholarship* (ed. C. Rust), 105-120. Oxford: The Oxford Centre for Staff and Learning Development.

Roberts, G. 2003. Teaching using the Web: Conceptions and approaches from a phenomenographic perspective. *Instructional Science*, 31, no. 2: 127-150.

Samuelowicz, K. and Bain, J. D. 1992. Conceptions of teaching held by academic teachers, *Higher Education*, 24, no. 1: 93-111.

Samuelowicz, K. and Bain, J. D. 2001. Revisiting academics' beliefs about teaching and learning, *Higher Education*, 41, no. 3: 299-325.

Samuelowicz, K. and Bain, J. D. 2002. Identifying academics' orientations to assessment practice, *Higher Education*, 43, no. 2: 173-201.

Thorpe, M. 2008. Effective online interaction: Mapping course design to bridge from research to practice. *Australasian Journal of Educational Technology*, 24, no. 1: 57-72.

Trigwell, K. and Prosser, M. 1996. Changing approaches to teaching: a relational perspective. *Studies in Higher Education*, 21, no. 3: 275-284.

Trigwell, K., M. Prosser, and F. Waterhouse. 1999. Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education*, 37, no. 1: 57-70.

Trigwell, K., E. Martin, J. Benjamin, and M. Prosser. 2000. Scholarship of teaching: a model, *Higher Education Research & Development*, 19, no. 2: 155-168.

Zemsky, R., and Massy, W. F. 2004. Thwarted innovation: What happened to e-learning and why? A report from The Learning Alliance, University Pennsylvania. Available at: http://www.irhe.upenn.edu/WeatherStation.html (accessed 17 April 2012).

Table 1. Relationships between conceptions of teaching, approaches to teaching and approaches to teaching and learning with technology

Conception of teaching	Approach to teaching	Conception of teaching with technology	
		Strategic	*Tactical*
Teacher-focused	Transmission of knowledge	Technology as agent of change	Replicating or supplementing existing practices
		Technologically deterministic	Presentational use of technology (passive) [PowerPoint, webcasts, etc.]
Learner-focused	Developing the learner	Teacher as agent of change	Transformational - considering how technology can enable learning goals to be achieved, skills and practices to be cultivated
		Pedagogically determined	Developmental use of technology (active) [manipulation & interrogation; reflection; knowledge building & sharing; etc.]