

How technology shapes assessment design: findings from a study of university teachers

Sue Bennett, Phillip Dawson, Margaret Bearman, Elizabeth Molloy and David Boud

Abstract

A wide range of technologies has been developed to enhance assessment, but adoption has been inconsistent. This is despite assessment being critical to student learning and certification. To understand why this is the case and how it can be addressed, we need to explore the perspectives of academics responsible for designing and implementing technology-supported assessment strategies. This paper reports on the experience of designing technology-supported assessment based on interviews with 33 Australian university teachers. The findings reveal the desire to achieve greater efficiencies and to be contemporary and innovative as key drivers of technology adoption for assessment. Participants sought to shape student behaviors through their designs and made adaptations in response to positive feedback and undesirable outcomes. Many designs required modification because of a lack of appropriate support, leading to compromise and, in some cases, abandonment. These findings highlight the challenges to effective technology-supported assessment design and demonstrate the difficulties university teachers face when attempting to negotiate mixed messages within institutions and the demands of design work. We use these findings to suggest opportunities to improve support by offering pedagogical guidance and technical help at critical stages of the design process and encouraging an iterative approach to design.

Introduction

Assessment is a key site of student engagement, playing critical roles in both student learning and certification. Technologies to support assessment have a long history in higher education—from the early days of programmed instruction and computer-based quizzes, to richer forms of interaction and content creation underpinned by constructivist approaches, and more recent tools that support online assignment submission, peer- and self-assessment, integrity checking and marking (Buckley & Cowap, 2013; Kulkarni *et al*, 2013; Schmid *et al*, 2009; Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011). The adoption of technology tools to support assessment in higher education has been inconsistent, despite the potential benefits (Warburton, 2009). Designers of assessment who depart from established practice risk complaints from students and criticism from colleagues. This may encourage conservatism in assessment design, particularly if integrating new technology tools is perceived as increasing the risks (Carless, 2009). But as with educational technology more generally, the reasons for limited adoption are poorly understood and warrant further scholarly investigation.

Prior research into technology in assessment has tended to focus on how learners interact with

particular technologies, often through detailed case studies of innovative projects. This work has been important in providing accounts of how emerging technologies might be integrated to support student learning, and identifying specific obstacles that might need to be addressed. There are two ways in which this body of work needs to be extended. The first is to specifically investigate the perspectives of university teachers who are responsible for assessment design. This would add specific consideration of issues related to assessment to current understanding of how and why teachers integrate technology into their teaching (see, eg, Jump, 2011; Kirkwood & Price, 2013). In addition, we need a broader account of technology integration in assessment that moves beyond specific projects by technology innovators and seeks to understand teachers' experiences in the context of more routine assessment design work. The need for accounts of educator experiences aligns with Selwyn's (2010) argument for research into the "state of the actual" in technology integration "concerning what is *actually* taking place when a digital technology meets an educational setting" (p. 70).

This paper explores the role of technology in routine assessment design, drawing from a larger study into teachers' assessment design practices in higher education (Dawson *et al*, 2013). The findings provide insights into how university teachers integrate technology into assessment and how technology influences their assessment designs. Selected examples highlight particular issues and quandaries that can emerge during the design process that help to explain variations in adoption. Finally, the paper suggests strategies to support change in teachers' assessment practices which may lead to more effective assessment designs and more consistent and widespread uptake of technology.

Methodology

The aim of this study was to develop a fuller understanding of assessment design by exploring university teachers' recent experiences when creating or significantly modifying an assessment task. We chose a qualitative approach using semi-structured interviewing to elicit context-rich teacher-focused accounts from which we could identify patterns and themes. We did not target technology innovations specifically, but instead sought routine instances of new or modified assessment design. As such, this was not a study focusing on technology-supported assessment innovation, but one in which the role of technology in assessment could be investigated across a range of new assessment designs. This reflected our interest in the "state of the actual" as opposed to the "state of the art."

Potential participants were contacted through institutional networks, such as by recommendation of the relevant Associate Dean (Education) or through faculty assessment documentation. Our inclusion criteria ensured sampling across disciplines (arts and sciences), from professionally oriented and generalist programs, and including varied classes sizes from large core units to smaller electives. This approach was chosen to capture examples from a wide range of assessment design contexts rather than attempting to obtain a representative sample. We recruited 33 academics from four Australian universities who were involved in assessment design in higher education courses. This included representatives from: arts/professions (education, journalism; 9), science/professions (health sciences, engineering; 8), arts/generalist (history, politics, languages, sociology; 7) and sciences/generalist (biology, physics, chemistry; 7).

The interviews were conducted using a semi-structured protocol, which asked interviewees to describe a recent instance of assessment design and then reflect on their broader practice. We asked participants a series of questions about what had led them to create or change the

assessment tasks, what had influenced their choices, the extent to which they felt ownership over the unit, any formal procedures they were required to follow, the extent to which the task was consistent with usual practice in their context, whether there was anything they had wanted to do differently, and how their assessment design practices had developed during their time as an academic. The interviews, which ran for around 60 minutes each, were audio recorded and transcribed for analysis.

Four members of the larger project team carried out the bulk of the analysis. Each read and annotated 12 transcripts and jointly constructed a coding framework. Two researchers coded the full dataset using qualitative analysis software, which was then confirmed and refined by team consensus. Excerpts from the full dataset coded as relating to technology were then analysed by grouping similar types of experiences. This was done through iterative refinements of a concept map as follows. Each coded excerpt was read within the surrounding context of the interview and then condensed into a short phrase that summarised its key content. The summary phrase was then added to the concept map by locating it near similar phrases and linking it with explanatory labels as required. As part of this process, some summary phrases were relocated and relinked as new relationships emerged. After all excerpts had been processed, four major groupings, each with several subgroupings, were evident. These groupings were further scrutinised by collating all of the original coded excerpts in a document according to the groupings, after which they were re-read for coherence and further adjustments made. Descriptive accounts of these four groupings were written, after which a thematic statement describing the overall content of each grouping was developed and refined by three team members. Consistent with our qualitative approach, the aim of this analysis was to provide an overview of our participants' experiences and perceptions, rather than to determine frequencies or distributions.

Findings

The presentation of the findings begins with an overview of our participants' past assessment design experiences and the range of recent assessment design examples discussed in interviews. This gives a sense of the overall dataset from which these themes are drawn. Our findings are then presented according to the four themes, supported by illustrative quotes from our participants. Care has been taken to select direct quotations that both typify common perspectives and highlight alternative views. This is intended to give the reader a sense of the complexity of the situations our participants found themselves in and the context-specific nature of many of the experiences imparted to us. Our aim in presenting these findings is to identify key issues that warrant further investigation and suggest practical implications. In doing so we follow a common approach to qualitative reporting that first presents descriptive accounts of data supported by direct quotations, followed by further interpretation in a subsequent discussion section.

More than half of our 33 participants had a formal teaching qualification, which is now required by many Australian universities prior to or early in an academic appointment. These ranged from a certificate in higher education (10) to a teaching qualification for another sector (9), e.g. primary or secondary teaching. Most participants were mid-career academics with established teaching experience. Our participants taught units of a range of sizes: from 10 to 1200 students, with a median of 180. They discussed recent assessment design experiences, ranging from traditional generic forms like essays or multiple-choice quizzes, to traditional discipline-specific

tasks like interviews or practice-based tasks, to new and often technology-enabled tasks involving media creation or online collaborative writing using wikis.

Theme 1: The “economics” of assessment drove adoption of technology to support assessment

Time and money constraints featured prominently in participants’ references to technology. This was particularly the case for large classes. Many felt there was pressure to adopt more apparently efficient forms of assessment, such as online multiple-choice quizzes that could provide automatic feedback to students:

“We’re getting this message from above that we’re supposed to be trying to cut down on our assessment and make it more time-efficient... efficiency in terms of marking. And so I’d say the economics of time and the increasing number of students has forced that to occur (Interview 18, occupational therapy).”

The ease of setting up and administering online quizzes was also attractive. A move to increasing use of online quizzes was evident across all discipline groupings, with efficiency cited as the main driver. Some participants expressed a degree of concern about whether this was good practice, but qualified their comments by identifying possible pedagogical benefits to students, such as encouraging students to self-assess and the immediacy of feedback to learners.

The introduction of video was another technology thought to offer efficiencies. Video was particularly appealing for assessment of practical competencies for which the alternative was resource-intensive practical sessions. As one lecturer in paramedics explained:

“Ideally, you would have [students working with] a simulated patient. And that’s obviously time and cost. So that would be ideal, but as it is, I think we’ll just have to stick with the video-type scenario (Interview 17, paramedics).”

Technology-supported forms of assessment also conferred other administrative benefits; for example, online submissions were stored centrally and could easily be referred to and retrieved. A particular example was online portfolios, which were considered quicker to mark and easier to manage. Technology also allowed for efficiencies in feedback design, with a number of participants describing their time-saving strategies of providing group feedback via the learning management system.

Designing new forms of assessment with technology also resulted in unanticipated challenges. In one case, there was an extra burden on students: “all the students had to submit their assignments in paper and online ... I think this is a rather silly doubling up of effort” (Interview 13, history). Problems also arose when students submitted files that could not be opened. Other new designs created marking inefficiencies, affecting the cost effectiveness of the assessment design. For example:

“I posted a couple of articles relevant to those topics on Moodle for [the students] and then they have to each enter into a discussion with their tutorial group about those articles. So, that’s been working well and all the students have been discussing that. In terms of my time, I’m finding it quite challenging to read 120 student discussions, and then try and mark them all for about seven weeks (Interview 17, paramedics).”

These experiences often led to revisions to make a design more manageable, and sometimes led participants to abandon it altogether.

Overall, economic considerations clearly led the participants in this study to prefer certain forms

of technology-supported assessment, particularly in light of institutional messages imparted either directly by supervisors or more subtly through workloads or resourcing. The need for labor-saving technologies influenced what university teachers considered possible and preferable in assessment design, but could lead to unanticipated consequences due to inexperience or lack of foresight.

Theme 2: Technology-supported assessment is considered contemporary and innovative

There was a sense from many participants that technology is a contemporary approach to assessment that is inevitably gaining momentum in higher education. This is illustrated by comments such as “generating a wiki and all working together online, I suppose that’s the modern way” (Interview 3, immunology) and “[we’ve been] thinking about electronic modes of assessment because ICT is starting to flourish” (Interview 22, biology).

In some cases, interviewees expressed a clear rationale for pedagogical improvement through the introduction of technology. In other cases, the approaches were shaped more by the tools available:

“I guess with Moodle coming on board and the ability to use the wikis, we thought we might try to use some of that... Just because the technology was available, we thought we might as well try some- thing different (Interview 3, immunology).”

Participants expressed frustration at the lack of time to do “something more interesting.”

Technology integration became a secondary consideration in their design processes: “In an ideal world, we’d love to be more innovative and do more online lessons, but we just don’t have time” (Interview 21, physiology). For one participant, this lack of time seemed to result in a disconnect between pedagogy and technology:

“It would have been nice if we could have brainstormed what we wanted students to achieve, rather than saying, “Well, how can ICT just be integrated within a subject?” (Interview 1, education).”

One participant described what he felt were mixed messages from his institution about preferred forms of assessment supported by technology:

I think there’s two trends in opposite directions that I’ve not gone along with. One is, on the one hand, a very kind of utilitarian, pragmatic trend towards labor-reducing assessment, multiple- choice quiz, no feedback ... that doesn’t have substantive pedagogical value and that is kind of lowering expectations. On the other hand, the other kind of assessment which is going the other way is towards more sophisticated, interactive and particularly digital forms of assessment (Interview 29, sociology).

This comment neatly summarizes the conundrum faced by many higher education teachers as they try to adopt new approaches while also designing appropriate and efficient forms of assessment for students. In summary, our participants variously regarded technology as modern, challenging, innovative, imperfect, and inevitable.

Theme 3: Technology-based assessment designs aimed to shape, and were shaped by, student behavior

Encouraging particular student behaviors was also a significant driver for technology-supported assessment. This included providing opportunities for students to self-test their understanding through online quizzes, which could free time in tutorial or practical classes for more effective forms of teaching and learning or to allow for targeted remedial support:

“Students prefer [online quizzes] because they have instant response ... [and] if they’re multiple-choice questions, I can see that they answered correctly at [a] 30% rate ... So, I can see if there’s this peak of something that’s a misconception for some reason, and then I can address that (Interview 20, astrophysics).”

Low-stakes online assessment was popular, partly because it was thought to promote consistent work over time. One common approach involved weekly online quizzes for nominal marks to motivate students to complete readings:

“We decided [on] quizzes, to ensure that they’ve actually done the reading. And this is what we’re finding is a problem. They don’t do the tutorial reading, they don’t access the set text and, with a lot, they don’t even bother to listen to the lectures (Interview 14, ancient history).”

There was a belief amongst participants that students expected and welcomed these forms of assessment, particularly online quizzes. Most interviewees who had adopted this approach felt it was successful, but one offered a more critical perspective: “I might do away with the online quizzes ... [It] was kind of a mechanical exercise designed to keep them from falling behind with the readings. I just think there’s probably a more effective way to do something like that” (Interview 13, history).

Others also reflected on the challenge of rewarding participation through appropriate credit for online activities, while at the same time acknowledging that collusion meant it was impossible to be confident students had submitted their own work. The compromise was generally that online activities received a small proportion of the marks. In contrast, some interviewees took a more relaxed view, for example: “I don’t care if they cheat ... I know a lot of my colleagues are absolutely, ‘Oh, if they’re doing it online, they’re looking it up,’ but they’re still learning. Their definition of cheating means they just don’t know it by rote” (Interview 12, Spanish).

Our participants also expressed concerns with respect to students’ technological access and ability. One interviewee described feeling restricted in what she could design because of limitations in students’ technical skills:

“There’s this assumption that the students are technologically savvy and they’re actually not. So, the extent to which you can embed technology into the assessment is limited by the reality of students’ existing technological proficiency (Interview 16, education).”

Others explained that they were unable to take full advantage of online quizzes for assessment because not all students had access: “Students just didn’t want to buy a book with the codes [for the online quizzes]. And so I had to give some students hard copies. And then it was only 20% of the students that have access” (Interview 20, astrophysics).

Taken together, the examples above demonstrate how new assessment designs were created or adjusted in response to student behaviors; for example, to combat a lack of student engagement, encourage self-directed learning and mitigate the risks of cheating or inequitable access.

Theme 4: Implementing technology-supported assessment requires support and compromise
Participants consistently identified inadequate support as a major challenge to their efforts to integrate technology into assessment. This was often exacerbated by their own inability to communicate effectively with technically oriented support staff:

“I think the support perhaps isn’t quite up to scratch, maybe because [the] people who are supporting Moodle may be still at the process of training themselves ... Also I don’t know how to speak to them in the language that they understand ... I can think of lots of things that I would like to do, but I have no idea if it’s actually a practical idea. I don’t know what the implications are and that stops you kind of moving forward (Interview 12, Spanish).”

Inadequate infrastructure also posed barriers to participants achieving everything they had hoped. In some cases, online tools could not be used to hold invigilated online exams due to limited computer lab space and students’ lack of access to specialist software. In other cases, limitations in the tools themselves or the ways institutions had implemented the technology caused challenges, resulting in tools that did not integrate (Interview 30, education) or limitations on access to possible collaborators outside the university (Interview 12, Spanish). These infrastructure issues meant that some options were simply not possible, even though participants regarded them as pedagogically and practically desirable.

Interviewees also highlighted the need to overcome other logistical hurdles associated with technology-supported designs. This involved both anticipating challenges when creating a design and adapting a design iteratively over several implementations to improve it. Participants described the need to find a way to make their ideas work using the technology tools available, often resulting in “work-arounds” and compromises. The risks of this kind of experimentation were high:

“Technology becomes really critical where assessment is concerned. If you set something up and it doesn’t work, they don’t trust you. Getting them on board again is a killer... students can be very hostile to you making mistakes. They’re not very forgiving (Interview 12, Spanish).”

In sum, support and compromise were powerful influences. Logistical challenges, the time required, unanticipated costs and the uncertainty of success were factors that led many participants to simplify or abandon their preferred designs.

Discussion

The findings from this study provide insights into the factors that shape what university teachers see as possible in technology-supported assessment. The “state of the actual” is a complex array of barriers and enablers that give rise to inconsistent adoption. Dramatic increases in university enrolments over the past decades have led to increasing pressure to efficiently assess large numbers of students, while also providing high-quality educational experiences and engaging in innovative practice (Nicol, 2010). Recent studies have explored how technology can reduce marking time and administration, automate feedback, improve students’ engagement with feedback and offer new opportunities for formative assessment (Atkinson & Lim, 2013; Daly, Pachler, Mor & Mellar, 2010; Nix & Wylie, 2011; Snodgrass, Ashby, Rivett & Russell, 2014). In this context, technology presents both solutions and challenges.

Part of the complexity indicated in our findings is that barriers and enablers are variable and context-dependent. This is not surprising, given that some forms of assessment are more appropriate or acceptable in some disciplines than others, some institutions are better resourced in terms of technology, some have more skilled support staff and some are less bureaucratic in technology policy and management (*Theme 4: Support and compromise*). Two experiences stand out as common across participants, however. One was negotiating the tension

between having to generate efficiencies in assessment while also implementing innovative pedagogies (*Theme 1: Economics of assessment*). While the dominant form of technology-facilitated assessment emerged as online quizzes, this was deemed pedagogically satisfactory rather than optimal. Many participants acknowledged their institution's goals and expressed an interest in developing new approaches using technology, but did not always feel capable of responding (*Theme 4: Support and compromise*). This is consistent with studies of e-learning adoption more generally (eg, Kirkwood & Price, 2013).

Another common experience was of a lack of time (*Theme 1: Economics of assessment*). Our participants variously mentioned lacking time to collaborate, solve technical and logistical problems, learn new skills or consult others. All of these affected their capacity to integrate technology into assessment. Technology adoption requires a commitment to learning new tools, but also access to good information about possibilities and appropriate support (King & Boyatt, 2014) (*Theme 4: Support and compromise*). Time-poor academics may be more likely to opt for what they see as quick solutions for assessment, like multiple-choice testing, if they lack awareness of and support for other approaches that could be pedagogically effective without being burdensome. Further scrutiny is needed to more fully understand the factors at work here and their consequences.

Our findings also highlight assessment design as co-constructed through interactions between academics, their institutional environment, the profession or discipline-based culture and the technology (all themes). Drawing from a socio-material perspective (Fenwick, Edwards & Sawchuk, 2011), the data strongly suggests that technology-supported assessment designs are the product of a dynamic relationship between the academic, the technological tool and the broader context. For example, several accounts of new approaches were clearly led by the functionality offered by the tool, and this was particularly true of tools embedded in learning management systems. That is, the specific uses of online quizzes, wikis or marking rubrics were a consequence of their availability, the teacher's desire to "do something new" and the broader institutional approach to technology in education (*Theme 2: Contemporary and innovative*). Further, when academics focused on pedagogical considerations, they often experienced challenges because the tools available were either not capable of or not configured for their design (*Theme 4: Support and compromise*).

Our findings also highlight the "romance" associated with adopting "cutting edge" technology-supported methods of teaching to demonstrate currency and teachers' capacity to take risks (*Theme 2: Contemporary and innovative*). Participants alluded to the "bravery" needed when combining assessment design with technology to brace themselves against criticisms from students and colleagues. Anticipation of students' preferences and skill levels also played a significant role in what was considered possible, demonstrating that it was not always the case that students are more interested in technology-supported teaching than are staff (*Theme 3: Student behavior*).

Participants' experiences of teaching with their technology-supported assessments help us to understand why some designs do not work in practice. The chief problems arose when new designs introduced unanticipated inefficiencies, particularly when marking proved more time-consuming than expected, or when an approach did not shape students' behaviors in the ways

intended (Themes 1 and 3). These issues were much more prevalent in our participants' experiences than technical failures during implementation. Assessment designs supported by technology were often adapted or abandoned in the next iteration of a unit. This suggests that strategies are needed to promote more thoughtful assessment design that is likely to have a life beyond the first year of trialing.

The findings have implications for practice at various levels within an institution. There are points in the assessment design process when prompting critical and realistic thinking about technology could reap significant benefits. Particular support is needed at what might be called the "initial ideas" stage, often during the preparation and review of the unit/course proposal. This is when academics are thinking of what they might like to do, and guidance about what is possible and practical with technology could be provided; for example, through more easily accessible, practically oriented resources. Different support is needed at the "planning" stage when unit coordinators are developing more detailed and concrete aspects of the design. This often occurs many months after the unit proposal is developed and approved, and is often performed by a different staff member. It was at this stage our participants described having to make compromises to manage the logistics by adapting their pedagogical ideas to suit the technology tools available. Discussions at this stage that plan for the marking load could be critical in avoiding some of the pitfalls our participants described. Finally, doing more to support academics in reflecting on the effectiveness of their designs, both during and after the teaching, would benefit technology-supported assessment designs in future iterations. These specifically timed strategies might also influence academics' sense of being time-poor and isolated by intervening at particular points where advice would be most useful.

The issue of being time-poor also prompts consideration of the allocation of workload. Technological solutions that lead to less burdensome assessment in the longer term can be inhibited by the prospect of an initial considerable investment of design and planning effort (*Theme 1: Economics of assessment*). This issue raises questions about how teachers could most effectively allocate their time to have the greatest impact on student learning. It may, for example, be desirable to devote more time to assessment design and provision of formative feedback, and less to content preparation and presentations.

Overall, these implications suggest that approaching assessment design as a process of formative development over multiple iterations could be greatly beneficial. This would lower the stakes at the beginning, enable a gradual roll-out over time, anticipate opportunities to gather evidence and reflect, and help to manage workloads and resourcing. Such strategies are familiar in instructional design work and large educational projects, but much more rarely implemented in the routine design work investigated in this study. These types of changes raise issues for institutional policies and practice, particularly those that determine how time is allocated within teaching workloads, how teaching and technical support services function, and how new teaching technologies are introduced.

In suggesting avenues for further research it is important to acknowledge the limitations of this study. Given the voluntary nature of participation, it is likely that our interviewees were those particularly interested and engaged in teaching, and may not represent the experiences of those for whom teaching and assessment are lower priorities. The scope of our interviews was also limited to what could be reasonably covered in around one hour and, as these were one-off

interviews, we are likely to have only captured some of our participants' experiences.

Research into the “state of the actual” in technology-supported assessment could profitably explore teaching practice across various institutional contexts to identify new issues or different emphases. A more detailed study of actual practice that traces the development of new assessments from the proposal stage through multiple iterations would be time-consuming but extremely valuable. Deeper exploration of the issues of time and resourcing as perceived by academics as they design and implement technology-supported assessment, and of the dynamic relationship between technological tools and design, is also needed to advance understanding of the barriers and enablers identified in this study. Further research in technology-supported assessment could also specifically target the needs of those with pedagogical concerns who want the most appropriate technological solutions, rather than the most innovative.

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Statements on open data, ethics and conflict of interest

This research was carried out according to protocols approved by Monash University Human Research Ethics Committee (approval number CF12/2496-2012001350). The data for this project is not available through an open repository due to difficulties in adequately de-identifying raw data to protect the identities of participants, while maintaining meaning in the dataset.

The potential harm from any breach of anonymity is substantial, as the participants sometimes discussed circumventing rules and norms that could cause professional or personal damage. Readers interested in more information about the data are invited to contact the authors for further discussion.

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References

- Atkinson, D., & Lim, S. L. (2013). Improving assessment processes in higher education: student and teacher perceptions of the effectiveness of a rubric embedded in a LMS. *Australasian Journal of Educational Technology*, 29, 5, 651–666.
- Buckley, E., & Cowap, L. (2013). An evaluation of the use of Turnitin for electronic submission and marking and as a formative feedback tool from an educator's perspective. *British Journal of Educational Technology*, 44, 4, 562–570.
- Carless, D. (2009). Trust, distrust and their impact on assessment reform. *Assessment & Evaluation in Higher Education*, 34, 1, 79–89.
- Daly, C., Pachler, N., Mor, Y., & Mellar, H. (2010). Exploring formative e-assessment: using case stories and design patterns. *Assessment & Evaluation in Higher Education*, 35, 5, 619–636.
- Dawson, P., Bearman, M., Boud, D., Hall, M., Molloy, E., Bennett, S., & Joughin, J. (2013). Assessment might dictate the curriculum, but what dictates assessment?. *Teaching and Learning*

Inquiry, 1, 1, 107–111.

- Fenwick, T., Edwards, R., & Sawchuk, P. (2011). *Emerging approaches to educational research: tracing the sociomaterial*. London: Routledge.
- Jump, L. (2011). Why university lecturers enhance their teaching through the use of technology: a systematic review. *Learning, Media and Technology*, 36, 1, 55–68.
- King, E., & Boyatt, R. (2014). Exploring factors that influence adoption of e-learning within higher education. *British Journal of Educational Technology*, 46, 1272–1280.
- Kirkwood, A., & Price, L. (2013). Missing: evidence of a scholarly approach to teaching and learning with technology in higher education. *Teaching in Higher Education*, 18, 3, 327–337.
- Kulkarni, C., Wei, K. P., Le, H., Chia, D., Papadopoulos, K., Cheng, J., *et al* (2013). Peer and self-assessment in massive online classes. *ACM Transactions on Computer-Human Interaction*, 20, 6, 1–31.
- Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass higher education. *Assessment & Evaluation in Higher Education*, 35, 5, 501–517.
- Nix, I., & Wyllie, A. (2011). Exploring design features to enhance computer-based assessment: learners' views on using a confidence-indicator tool and computer-based feedback. *British Journal of Educational Technology*, 42, 1, 101–112.
- Schmid, R., Bernard, R., Borokhovski, E., Tamim, R., Abrami, P., Wade, C. A., *et al* (2009). Technology's effect on achievement in higher education: a Stage I meta-analysis of classroom applications. *Journal of Computing in Higher Education*, 21, 2, 95–109.
- Selwyn, N. (2010). Looking beyond learning: Notes towards the critical study of educational technology. *Journal of Computer Assisted Learning*, 26, 65–73.
- Snodgrass, S. J., Ashby, S. E., Rivett, D. A., & Russell, T. (2014). Implementation of an electronic objective structured clinical exam for assessing practical skills in pre-professional physiotherapy and occupational therapy programs: examiner and course coordinator perspectives. *Australasian Journal of Educational Technology*, 30, 2, 152–166.
- Tamim, R. M., Bernard, R. M., Borokhovski, E., Abrami, P. C., & Schmid, R. F. (2011). What forty years of research says about the impact of technology on learning. *Review of Educational Research*, 81, 1, 4–28.
- Warburton, B. (2009). Quick win or slow burn: modelling UK HE CAA uptake. *Assessment & Evaluation in Higher Education*, 34, 3, 257–272.