Obstacles and opportunities for technological innovation in business teaching and learning

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Abstract

Pressure to change business education is rising. Lectures, where students listen to an expert academic should be the exception rather than the rule. A reliance on passive learning tasks reflects an information-transmission concept of teaching which produces inferior learning outcomes. Incorporating new learning and assessment tasks can improve learning outcomes. Since technology is one source of innovation currently in the spotlight, this paper describes the opportunities and the obstacles to improving outcomes through technological innovation. If business academics are to optimise educational innovation, more rigorous design, implementation and evaluation is needed.

JEL Classification: A22, A23, O33.

Key words: Accounting education, business education, computer based learning, web based learning, educational evaluation.

Introduction

The objective of this paper is to describe how opportunities for improved outcomes can be grasped when adopting technology-supported learning and assessment tasks in business education. The motivation for this paper is to help business academics to develop better business courses during a period of change and pressure to change (Albrecht and Sack, 2000). It is not to advocate unreflective adoption of technology.

Teaching in all disciplines has been subjected to unprecedented scrutiny and pressure to change (Ramsden, 1998, 1992). Business education is no exception. In the US, the Accounting Education Change Commission (AECC)[1] (Williams, 1993) was a notable catalyst in accounting. As Sundem (1999) states: “without the AECC, we might not be experiencing the curricular changes currently being implemented by nearly every accounting program” (in the USA). While the AECC concentrated on content, it has also had an impact on instructional design (Sundem, 1999). In Australia and New Zealand similar changes are occurring (Abdolmohammadi, Novin, and Christopher, 1997; Adler and Milne, 1997, 1998).

Changes in the teaching and practice of business have also been brought about by technology in the US, UK and elsewhere (Lont, MacGregor and Willett, 1998; Nicholson and Williams, 1994, Green, 1999). Despite such curricular and technological developments, tertiary educators in accounting and economics appear to have lagged behind other disciplines in adopting new teaching and learning strategies (Becker and Watts, 1999; Adler and Milne, 1998). Albrecht and Sack’s (2000) verdict is worse. Based on their evidence, they proclaim that the dominant educational model must be broken and obsolete.

Technology-supported innovation does provide fruitful possibilities for improved outcomes for business students. This paper provides an approach for evaluating possible choices for enhancing student learning in the modern technology-supported university. The results will be of interest to business educators as well as academic managers interested in promoting effective educational innovation.

The second section of this paper examines the main motivations for adopting technological innovation in higher education and notes that the rethinking of a course can improve student learning more than the addition of technology alone. The third section describes how improved learning can result from a student-centred conception of teaching. Innovations featuring technology are described. The fourth section details the circumstances in which opportunities are likely to arise for technology to add value. The fifth section outlines the main obstacles to value being added by educational innovation. The perspectives of students, academics and institutions are considered. Section six discusses the implications for academics and academic managers. In adopting learning innovations it is crucial that changes match the needs of learners, their academics and institutions. The final part concludes that the opportunities for innovation should be grasped and that obstacles can be overcome.

Motivations for adopting technology-supported teaching and learning

Chong (1997) maintains that there are two major goals of integrating technology into accounting education: to prepare students for computer usage in their prospective workplace and to enhance student learning. In their study of 104 nationally funded technology innovations in higher education in Australia, Alexander and McKenzie (1998) identified two further popular motivations for integrating technology: to enhance departmental or institutional reputation and to improve productivity for students, academics and departments.

Alexander and McKenzie (1998) reported reputation as the only outcome (34% of cases) achieving in excess of that expected (32% of cases). Developing technology capabilities for business students appears quite positive (Lont, MacGregor and Willett, 1998; Brooksbank, Clark, Hamilton and Pickernell, 1997; Goggin, Finkenberg and Morrow, 1997; Leidner and Jarvenpaa, 1995; Aiken and Hawley, 1995; Baker, Hale and Gifford, 1997; Scigliano, Levin and Horne, 1996). In regard to productivity, Alexander and McKenzie (1998) report serious under-achievement. 39% of cases expected student productivity to improve but this was achieved in only 12% of cases. Expected productivity improvements were under realised for academics (36% versus 25%) and for their departments (44% versus 25%).

The most common motive for technology-supported innovation in higher education, claimed by Australian academics in Alexander and McKenzie's (1998) study, is enhancing student learning. Early claims for technology related to easier access to material and more rapid feedback (McKenzie, 1977), especially beneficial for weaker students (Beard and Hartley, 1984). With the advent of interactive multimedia (i.e. text, sound, animation and video) and the Internet, there has been no shortage of wild but unrealistic claims about technology helping students learn. In Alexander and McKenzie (1998), only 37% of cases reported an improvement in student learning compared to 87% that were expected to do so.

That student learning is not enhanced simply by innovating with technology, should not be surprising. It is a result that has been reported for decades. Russell (1999) summarises over 350 studies that suggest that the use of computers *of itself* makes no significant difference to student learning. It is not the resources, but rather the integration of resources into appropriate activities that result in an improved learning environment. McQuillan (1994) documents this subtlety in a case study where changes were planned with the intention to convert a course into a technology-supported environment. Although the conversion to technology did not eventuate, student outcomes improved because the academics incorporated the active learning tasks into their face-to-face classes that arose from the redesign.

A teaching conception for improving learning with technology

Standard higher education texts (e.g. Biggs, 1999, Ramsden, 1992, Laurillard, 1993, Hiltz and Turoff, 1993) can tell us much about how to design learning environments and avoid common misconceptions about technology's role in education. A qualitatively superior learning outcome occurs when understanding is transformed - when students change the way they understand and interact with the world around them (Ramsden, 1992). A graduate undertaking a capital budgeting evaluation for their employer several years after graduation that excludes interest expense in determining free cash flows, has demonstrated high quality learning. Their understanding changed as a result of their studies. An inferior outcome is where learners achieve no real transformation through the educational process. The immediate loss of memorised facts following an examination is an example of poor quality learning. Although academics want quality learning outcomes for their students, Ramsden's (1992) synthesis shows they occur much less than they should.

The main variable affecting whether students learn is students' approaches to learning (Marton and Säljö, 1976). After a quarter of a century and much research (Biggs, 1999, Ramsden, 1992), its primary role in determining learning outcomes remains. Students adopting a deep approach expect to change their understanding and approach a learning activity intending to do so. Surface approaches are satisfied with memorising isolated facts. Students' approaches to learning are fragile and can be affected by their learning environment, prior experiences, conceptions of learning and subject design. Prosser and Trigwell (1998) show that academics' conceptions of teaching affect their design decisions and students approaches to learning. Academics viewing teaching as information transmission are less likely to design courses that encourage their students to take deep approaches to learning. Surface approaches are more likely to be designed by such academics.

If teachers' conceptions are fundamental to improved student learning by nurturing environments that encourage deep approaches by students, then it should be no surprise when technology proves of itself not to be crucial (Russell, 1999). Laurillard (1993) and Biggs (1999) show that quality learning may just as likely occur when technology has been used to support learning as when it has not. After all, it is the activities students engage in which affect student learning, irrespective of whether they are delivered by an academic, a printed study guide and text or a computerised program. Poorly planned or superficial teaching strategies utilising technology, like 'dumping lectures on the web', have as much chance providing an instant improvement to student learning as placing another good book into the library. Benefits are more likely to arise if learning environments are carefully constructed to incorporate active learning tasks that are aligned to objective outcomes and assessment (Biggs, 1999).

In a similar vein, Chickering and Ehrmann (1997) encourage academics to "eschew materials that are simply didactic, and search instead for those that are interactive, problem oriented, relevant to real-world issues and that evoke motivation". Opportunities and obstacles arising from the application of their seven principles of good teaching practice are demonstrated in Table 1.

Any approach to making decisions about teaching and learning must include evaluation to ascertain if expected outcomes have been achieved. But it is not only technology innovations that ought to be evaluated. In the light of Ramsden's (1992) criticism of the effectiveness of current approaches to deliver quality learning outcomes, the status quo, including a reliance on lectures as the main teaching and learning activity, needs evaluating.

Research in education is far from an exact science (Cohen and Manion, 1994). The manifold variables are rarely measurable or controllable (Reeves, 1993) and alternative plausible explanations abound.[2] For example, higher test performance may result from differences in student motivation, age or prior education experience or differences in teacher, text or technology. Such factors could account for the superior performance in pre- and post-test scores by online students reported by Dixon (1996) in Table 2.

Similarly, alternative plausible explanations could explain the results of Baker, Hale and Gifford (1997) who note students choosing a technology-learning option performed better in the same and subsequent courses whether or not the latter included technology. This could equally be a case of self-selection by the more able or conscientious students.

Principle	Technology opportunities	Technology obstacles
Good practice encourages contacts between students and faculty	Asynchronous communications technology greatly enhances the opportunities for staff-student interactions. Learners reluctant to ask staff oral questions benefit from written interactions. Commuting part time adult learners particularly benefit from improved access.	Accessibility of staff to students, if not defined and limited, can encroach on or even swamp research and other priorities.
Good practice develops reciprocity and cooperation among students	Asynchronous communications technology improves student-student interactions and strengthens group problem solving, collaborative learning and discussion of assignments.	Easy communication between students can breed laziness and cheating if learning tasks are not carefully designed.
Good practice uses active learning techniques	Technology has massively encouraged learning by doing instead of watching. Search facilities are significantly enhanced. Simulations of real world situations can be easily played out.	Pragmatism may drive out concern for theory. Ease of access to simulations may reduce awareness of fundamental principles.
Good practice gives prompt feedback	Technology greatly increases the ability to achieve instant feedback on learning progress (e.g. auto-corrected quizzes, hidden comments in presentation files, and access to student and staff feedback on discussions).	Students may come to expect instant feedback even where staff needs to spend time providing personal feedback.
Good practice emphasises time on task	Technology can make studying more efficient as learners spend less time commuting and queuing for resources.	Technology must encourage learners to spend time on appropriately designed and assessed tasks.
Good practice communicates high expectations	Greater exposure to real life problems through technology sharpens motivation to acquire information as well as cognitive analysis and application skills. Web publishing adds discipline. Good examples of student work can be easily made available as benchmarks for future cohorts.	High standards of presentation may be beyond the means or technical skills of some students. Presentation skills may eclipse understanding in assessment.
Good practice respects diverse talents and ways of learning	Technologies expand the repertoire of learning resources that may particularly suit some learners. They can allow for more individualised learning by tracking progress.	A wide range of options can leave students feeling overwhelmed, stressed and isolated.

Table 1. Opportunities and obstacles of technology-supported learning

	Pre-test Score		Post-test Score	
Program	Bus. Admin.	MBA	Bus. Admin.	MBA
On-Campus	26.5	41.5	37.1	53.9
On-Line	34.73	51.2	43.5	62.4

Table 2. Mean major-field achievement scores for on-campus and on-line students

Self-selection could also explain Kiser and Toreki's (1997) results in Figure 1. Students choosing to progress test themselves with the optional online quizzes performed better in the exam the more optional quizzes they undertook. Similarly, Freeman's (1998a) result that found students using a computer-based learning program for finance consistently scored higher than those who had not, could be the result of self-selection by the more motivated students.

These examples illustrate the problem of confounding variables with experimental research on student performance (Reeves, 1993) and the need to plan changes based on plausible explanations such as the effect on students' approaches to learning. Without planning for how technology-supported learning tasks might add value, "there is a risk of making an ineffective process more efficient – but less effective – through automation" (Alavi, Wheeler and Valacich, 1995).

These examples illustrate the established premise that teachers' conceptions of how students learn, with or without technology, is crucial if improvements in student learning outcomes are to be achieved.

Opportunities for improving learning with technology

If there is no fundamental reason why using technology or any other particular learning resource to support students should produce superior learning outcomes, then in what circumstances might technology add value?[3] We identify three broad circumstances, going beyond our application of Chickering and Ehrmann (1997), in which technology may encourage students to adopt deeper approaches to learning.

First, technology-supported learning activities can sometimes facilitate improved student learning when they provide a more conducive environment for the learning activity. Freeman and Capper (1999) found graduate students participating in an online role play about securities markets regulation felt less inhibited because roles were anonymous. Anonymity gave students a greater freedom to understand other views by applying them without risk in simulated real-life situations. Females and students from non-English speaking backgrounds were more involved in online learning tasks than in the face-to-face learning tasks. Olaniran, Savage and Sorenson (1996) found students using computer-mediated communication generated more ideas than those using only the face-to-face option in a

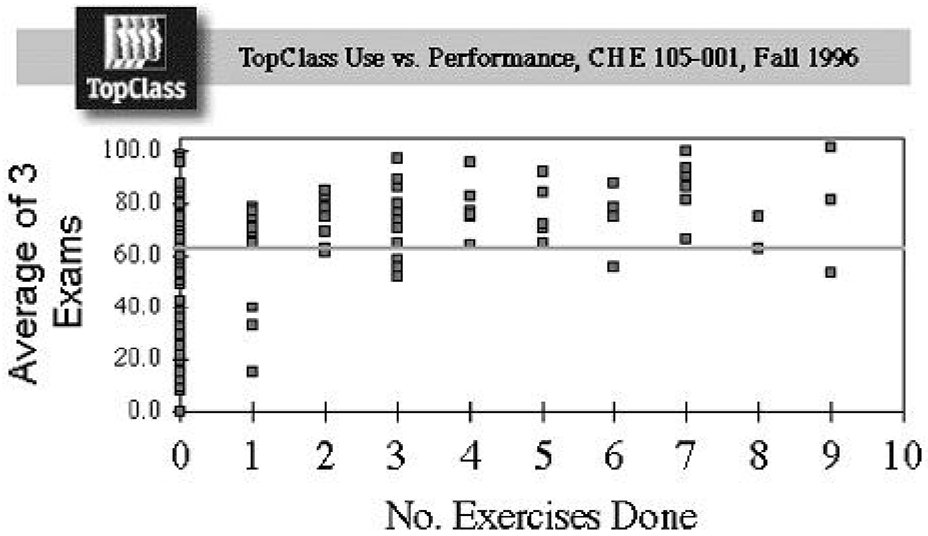

Figure 1: Kiser and Toreki's results

communications class. In both cases, the technology helped students adopt deeper approaches and learn because they felt less inhibited.

Second, technology might facilitate improved learning if it improves access to learning activities that encourage deep approaches and with which learners might choose to engage. Freeman (1997) found more students could practise on past finance exams when access to them was provided online. Electronic access overcame a theft problem experienced with relying on print access for hundreds of students. In Kiser and Toreki (1997), the web-based learning system TopClass provided improved access to practice tests and feedback. Without automating the process, the academics would have struggled to provide so many students with access to multiple experiences of the useful learning task. Self-selection may, therefore, be only part of the explanation for superior performance in exams. Without the technology, more motivated students would not have had as many opportunities for self-testing.

Third, improved learning outcomes may also arise when innovative technology-supported learning activities result in improved attitudes. Alavi, Wheeler and Valacich (1995) note that the remote group in their teleconferencing tests had a higher commitment from group members and higher critical thinking scores than face-to-face groups. Similarly, McComb (1994) reports that computer-mediated communication nurtured student involvement and initiative. In their review, Alexander and McKenzie (1998) found improved attitudes to be the single most significant result (62.7%) following the introduction of an innovation even though expectations of improved attitudes were low (16%) across 104 projects. Improved attitudes may have arisen in some cases because the enthusiasm of the academics introducing them encouraged students to take deeper approaches to learning. It could also have been that it was only the 'novelty value' of the innovation that was attractive. This can arise from any activity, not just technology-supported innovation (Biggs, 1999). Generalised statements about technology *per se* improving attitudes should therefore be treated with caution.

These three circumstances may interact. For example, Freeman (1996) found the provision of an online facility in a business subject to have questions answered was very popular. Asynchronous access helped overcome problems experienced by 850 students between several campuses asking common questions when staff numbers were reduced. Anonymity of access also played a significant role in its popularity. A combination of the effects of access and attitude were evident in Althaus (1997) who noted improved access for students with disabilities to participate when using asynchronous discussions. In addition, students tended to become more reflective and more attentive to the messages of others when placed on a more even social footing with each other.

There are opportunities to add value but these depend on how academics integrate the technology-supported learning activities. Technology offers a greater range of resources for matching to student needs and desired outcomes. Reduced risk in expressing uncertain or developing understandings (e.g. though anonymity), increased access (e.g. for when and where students can study) and motivational benefits (e.g. novel learning tasks) are three circumstances in which improved student approaches to learning with technology might be expected. We reiterate however that there is no certainty of outcome, let alone instant improvement, if academics adopt innovations without carefully planning to avoid the obstacles. Knowing these obstacles should assist in developing pre-emptive strategies when innovating.

Obstacles to improving teaching and learning with technology

The major obstacles to learning innovations involving technology have been identified by Bacsich, Ash, Boniwell and Kaplan (1999), Alexander and McKenzie (1998), Hara and Kling (1999) and Rumble (1999). Obstacles are categorised by typical stakeholder group.

Students

- Experiencing frustration due to insufficient technical support. Examples include: inadequate facilities in number or quality required undertaking a learning task; hardware failure; software bugs.
- Experiencing frustration or isolation due to poor academic support. Examples include: slow or aggressive responses to student email or online discussion questions and unclear expectations of what is required.
- Experiencing boredom or tiredness because learning activities are poorly designed or integrated. Examples include: relying on reading a lot of text on screen when it may be more convenient to read a book on the bus and assessment left unchanged despite the innovation and so students do not see relevance in their technology-supported learning.
- Ignoring the technology-supported learning activity because they are unaware of its usefulness. This typically occurs if students' prior experiences with surface approaches to learning have resulted in success; if academics do not demonstrate its use, make it easy to access or indicate its relevance as a productive use of student time or money.

Academics

- Experiencing unfavourable feedback from students because learning activities are poorly designed or integrated. Some fine innovations fail to achieve their expected outcomes due to a lack of congruence in design. Students simply saw no reason for using them perhaps because assessment did not change. This is likely to occur if academics have information-transmission conceptions of teaching.
- Experiencing disinterested and unsupportive department heads and colleagues.
- Experiencing poor technical support. Examples include: slow or inadequate response from network staff or software providers when queries are made.
- Experiencing more time being consumed communicating with students, even when class sizes are no larger. The Open University reports learner support being a major workload increase with online subjects (Rumble, 1999) over traditional correspondence courses.
- Experiencing frustration finding suitable software, mounting it, resolving human and technical conflicts and integrating it into their courses.
- Experiencing embarrassment because new problems were unexpectedly introduced with an innovation.
- Ignoring student feedback. Adler and Milne (1998) criticise business educators for this.
- Perceiving that a particular technology-supported activity is incompatible with existing work practices, too complex or too difficult to try or has no potential competitive advantage to them (Geoghegan, 1996). Adler and Milne (1998, p.26) note that accounting academics too often "appear to be conducting their teaching as they were taught versus as (sic) how it might be taught".

Institutions

- Experiencing poor project management (e.g. budget overruns, shortfalls on outcomes) and poor returns on investment. Video conferencing of a finance subject across two campuses resulted in no measurable increase in learning but produced a sharp jump in financial costs for the institution and personal and time costs for the academics involved (Freeman, 1998b).
- Experiencing low level commitment to innovation by academics because of perceptions of inadequate support or reward policies. Examples include: lack of suitable hardware, technical support or instructional design support; administrative constraints like timetabling computer laboratories; biases in promotion criteria; unattractive intellectual property rights policies. Low level commitment is evident when directives to redesign into flexible learning are met by a simple repackaging (e.g. lecture notes converted into a web-readable form).
- Relying on inadequate information for decision making. Examples include: reliance on anecdotal evidence and small

samples; a reliance on reaction-based evidence instead of evaluating other effects like learning.

Discussion and synthesis

It is obvious that benefits must be weighed against costs. Unless academics can see similar outcomes being obtained with the same or less total resources, then any innovation is likely to languish (Abdolmohammadi, Novin and Christopher, 1997). Even significant enhancements in learning will falter if the costs, to students, academics or institutions, are too high.

The focus must go beyond curricular changes and careless adoption of a new technology-supported teaching method or learning activity. Technology is merely a supporting resource that can be just as discouraging to students' learning as a text that contradicts a lecturer. There is increasing evidence that funding is not the sole answer to improving learning outcomes (e.g. Alexander and McKenzie, 1998). No amount of resourcing (whether textbooks, computers or websites) will improve student learning without academics designing appropriate learning activities (e.g. tutorial questions, problems and discussions) and setting assessment tasks (e.g. case studies, practice sets, exams). Unless these activities facilitate student engagement and interaction with those learning resources, students will adopt surface approaches and merely rote learn the concepts (Ramsden, 1992).

To provide the best learning context academics have three main tasks.

First, academics must **read** the contextual variables to be aware of the external and internal factors affecting their students, including the needs of their community and profession. Gathering data on student access to the Internet or professional priorities for graduates being able to use the Internet must precede making its use essential.

Second, academics must **match** learning resources, tasks and assessment to student abilities and needs. No matter how wonderful an accounting practice set available in the university lab is, without reliable access at times that suit students, it will not be used. They are also less likely to use it if there is no clear link between the learning tasks and future assessment, if it is not relevant to that particular group of students which could be as simple as the use of $ instead of £, or if any of the other obstacles noted above are not addressed.

Third, academics must be diligent in **evaluating** outcomes. Improvements are more likely to be identified if data is being collected on the effectiveness of existing *modus operandi*! It is hypocritical to place stringent benchmarks on a technology-supported teaching or learning activity when current activities like lectures are not evaluated in terms of their learning outcome. Business educators are familiar with the concept of post-audits of capital expenditure decisions and comparing actual with budget to establish if NPV was achieved. Doing this with educational investments is the same in principle but much more difficult to implement because of measurement problems identified by Reeves (1993). Controlled experiments are rarely possible in higher education research because there are so many confounding variables and alternative explanations. Furthermore, evaluation needs to go beyond a focus on technologies to the essential goal of improving student learning rather than simple student reactions (Laurillard, 1993). Student evaluations alone, however, are insufficient to "get inside students' heads" (Brookfield, 1995, p. 92), and need to be complemented with other data of student learning[4]. Kirkpatrick (1994) suggests going further to evaluate the impact of learning on organisations. Good evaluation is ongoing and leads to continuous refinement of teaching and learning strategies.

Conclusion

The objective of this paper is to describe how opportunities for improved outcomes can be grasped when adopting technology-supported learning and assessment tasks in business education. Innovation in business education, whether technology-supported or not, is possible and necessary if the next generation of practitioners is to be given the best grounding possible for their professional life.

Opportunities for technology-supported learning abound and obstacles can be overcome. Many universities have adopted flexible learning policies. These provide opportunities where new technology and non-technology resources, learning and assessment tasks can be matched to student needs and expectations of professional bodies. Any innovation trialed needs thorough evaluation so that all stakeholders' interests are served. Technology-supported teaching, learning and assessment activities may be cost-beneficial in some, but is unlikely in all circumstances or for all stakeholders. Any activity that encourages students to take a deep approach to learning, whether technology-supported or not, ought to be considered for adoption.

There are two major challenges facing academics and institutions. First, re-engineering business courses will produce optimal results when more academics and managers hold a conception of teaching as being more about changes in understanding and less about information transmission. Second, there is a dire need to better quantify the uncertainty surrounding costs and benefits of this important activity we call teaching, including how they can be measured and how they are allocated. By using their discipline skills in evaluating their teaching, including developing methods of costing, business academics can offer much to universities as well as their profession. Ongoing feedback from multiple stakeholders using multiple methods is essential to quantify all costs and benefits. Without academic management being mindful and allowing for the cost associated with this, the potential net present value of a technology supported learning environment will not be realised.

Endnotes

1 See the AECC's website at http://www.rutgers.edu/Accounting/raw/aaa/facdev/aecc.htm

2 It is beyond the scope of this paper to review all the accepted educational research instruments and methods. Interested readers can start with Biggs (1999) or Ramsden (1992) for explanations of reliable approaches like the Course Experience Questionnaire, the Study Process Questionnaire or the Structure of the Observed Learning Outcome.

3 Maier, Barnett, Warren, and Brunner (1998) provide a good introduction to the use of computers in education, concentrating on both educational and technological aspects.

4 Qualitative differences in learning can be obtained through a SOLO analysis (Structure of the Observed Learning Outcome) for example. See Biggs (1999) or Ramsden (1992). Analysis of aggregate responses to specific questions, tutor feedback and network reports are other sources of data.

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