SMALL SCALE TECHNOLOGY ADOPTION INITIATIVES ARE THEY WORTH THE EFFORT?

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1. EXECUTIVE SUMMARY

Technology adoption in support of teaching and learning is not new; however since the advent of the routine use of information and communications technology (ICT) in support of tertiary level education we have experienced many initiatives, some at department level, others at institutional level and many at national and international level. How many of the grander initiatives, or the more modest, clearly demonstrate long-lasting benefits to the consumer; the student? This paper addresses the question by examining activities in the University of Ulster and concludes that "small scale" initiatives are beneficial to students, staff and cultural change.

2. CONTEXT

2.1 The University of Ulster – Historical Context

The University, established in 1984, is one of the United Kingdom's newer universities. Its roots are in the erstwhile polytechnic sector, with one of its founding institutions dating to 1972 and its earliest campus established over 150 years ago. Our use of ICT in teaching and learning dates from 1972, with many local and national level innovations now part of that heritage. Today we operate a virtual campus and we consider our ICT provision to be pervasive, contemporary and highly relevant to the needs of our students and academic staff.

2.2 The Teaching and Learning Environment - Challenges

Today's higher education sector faces a demanding portfolio of strategic issues and challenges; financial, suitability of physical environment, student attraction to tertiary education and retention, widening participation in higher education and the burgeoning service quality demands on those who facilitate teaching and learning. Hartman (2008) refers to the employing of technology in teaching and learning as "one of the most conspicuous pieces of unfinished business given the centrality of teaching and learning to the academy". What constructive pedagogical role can technology play in this changing and ever-demanding environment? Can the roles positively benefit the student experience? Does contemporary ICT aid learning, student motivation, development of new and relevant competencies and perhaps ultimately create a workforce that improves our economy?

2.3 A Pragmatic Approach – Not a Research Project

Ulster has a major investment in ICT in support of teaching and learning and this investment is part of our ICT strategic development plan as well as a technology underpinning for the Teaching and Learning Strategy. The university has a well-established centrally-managed responsibility for a major element of these ICT facilities and associated services. Its Information Services Department (ISD) assumes this responsibility, as an administrative organisational unit. The technology scope encompasses videoconference services, an extensive provision of digital classrooms and lecture theatres, pervasive wired and wireless networks and student desktop computing facilities in Learning Resource Centres and in computing laboratories. This infrastructure is reported upon elsewhere [Wilson et al, 2008]. Furthermore, we seek to develop and promote relevant innovative applications which 'touch on' pedagogy rather than merely use ICT in the traditional application sense. For example, work involving audience response systems, tutor-led tutorials using the writing surface of wireless tablet pcs and the use of presentation software are typical of the 'value added' pedagogically-focussed work referred to.

3. ULSTER'S APPROACH

3.1 Overview

The ISD, with responsibility for this hardware base, provides a small team with responsibility to work with academic staff and students to identify "technology opportunities in the classroom" and to pursue "the relevance of specific technologies to particular pedagogical challenges". This work is project-based and the academic participants are actively encouraged to publish their findings and to promote their projects internally. Our focus is not upon establishing large-scale long-term projects with substantial funds and a clear research focus; we are primarily interested in developing a base level of research in the broad area of "technology enhanced teaching and learning". A small annual budget of approximately 40,000 euros is available to provide "pump priming" support.

3.2 How the Structural Model Operates and its Scope

The role of the Project Coordinator (Technology Adoption) (PCTA) is amorphous to reflect myriad ways in which academics aspire to incorporate new or existing ICT into their teaching. The operational complexities associated with a geographically dispersed four-campus institution spread over a distance of 120 kilometres are a challenge. For example effectiveness of internal communications is a barrier to staff wishing to learn about innovations and projects on another campus. This issue is compounded when innovations within one Faculty should be promoted to staff in other Faculties. There are three principal strands to the PCTA's role:

- Institutional promotion
- Formal support for academic departments and
- Individual support for staff.

These roles are summarised in Table 1 below.

Table 1

Responsibility of the PCTA	How Responsibility is Delivered
Cross-campus – Cross-faculty promotions and networking	- Formal and informal presentations at School and Faculty level e.g. School/Faculty Staff Information Days - Formal and informal communications with each Faculty IT and Teaching and Learning Co-ordinator (an academic) - Publications in In-house Newsletters e.g. Information Services' and the University 'house magazine' - Partnership presentations in a regular seminar series with academic staff engaging with ICT initiatives
Training and Advice	- School staff training events - Contributions to events organised by the University Staff development Unit - Membership of appropriate Committees including the Centre for Higher Education Practice - Informal advice and guidance on ICT and on its uses - Individual support for academics to aid integration of technology and pedagogy
Communications	- Informal verbal and e-mail contacts with individuals about interest acquired e.g. from journals, conferences, peers - Educational technology seminars promoting in-house experiences

4. AREAS OF APPLICATION

In the examples selected, the provision of tools to meet students' expectations, the need to provide professional support and development to new members of faculty and a desire to improve learning outcomes are key considerations. Large class sizes, student retention and motivation, the "digital native" in the tertiary sector and institutional reputation for quality of provision and results are some of the challenges we address. In common with Campbell's (2007) paper, the factors identified are paralleled with those in the EDUCASE survey on "Top-Ten Teaching and Learning Issues".

4.1 Audience Response Systems (ARS)

Active participation in learning has been shown to motivate students, and encourage their engagement with the learning resources (Kolb, 1984). In previous research, the active participation garnered through the use of Audience Response Systems has been shown to engage passive students (Guthrie and Carlin, 2004), improve attentiveness in class and improve student engagement (Kam and Sommer, 2006; Judson and Sawada, 2002), increase knowledge retention (Poulis et al, 1998), improve achievement of learning outcomes for the module (Kennedy and Cutts, 2005) and provide students with a reflection of their understanding of key points of the module.

The technology is not new, however its use at Ulster is relatively new with an uplift from some 60 units in 2005 to approximately 1200 occurring in a 3-year window. Now several Schools have introduced [1]TurningPoint® to all first-year undergraduate classes. Two particular projects illustrate differing pedagogical needs; one where a new member of staff sought to adopt what he had used in a previous employment, and another who wished to use it with first and second year students and a postgraduate cohort. In the case of the second example the pedagogical imperative was "to engage first-year undergraduate students more with their course".

The PCTA worked with the academics, organising pilot projects and staff training including guidance on the pedagogic use of the technology. The support role was to help the academics identify how they would use the technology in their teaching. Technical support and pedagogic feedback was

[1] TurningPoint is a Registered Trade Mark of TurningTechnologies LLC.

given during initial teaching sessions. The importance of ensuring technology works correctly cannot be under estimated in such developmental situations and pedagogic feedback facilitates seeking responses from the student cohort about the style of questioning used and conveying suggestions for improvement in future lectures.

An evaluation was conducted over the course of the module, with feedback sought from students and lecturer, to ensure both groups were benefiting from the new innovation. Both the academic and the students felt the technology was highly beneficial; see Table 2 below.

Table 2

Student Feedback
"Everyone was like a 'whole', rather than just in a class where one person sometimes gives all the answers. It helped everyone to be part of the class"
"Opportunity to see how my opinions sat beside the opinions of my class mates"
"[We] could give an answer without the embarrassment of being wrong or right and it give us feedback on where we stood with regards to the subject."
"If I got a question wrong I didn't feel as stupid as I would have if it was in front of the whole class."
"[TurningPoint] Made the class more interesting and made me listen more as I knew I would be asked questions"
"It's a two-hour lecture – you are bound to lose interest after 15 minutes so the AR system kept me awake, alert and interested"

Through word-of-mouth, other academics in the same discipline areas sought use of the Audience Response System in their modules. This response then spread to other Schools and beyond. The lecturer associated with the second example cited above was awarded a Distinguished Teaching Fellowship by the University, partly for her innovation with TurningPoint. Demand for the technology has grown to the point where several Schools now require all their students to have their own transmitter, which is then used across their modules over the course of the full semester.

As part of our policy to evaluate a technology and its use, a survey (N=290+) was conducted with students from across the various disciplines now using Turning Point. The results were highly positive; see Table 3 below.

Table 3

Aspect	**Percentage**
Enjoyed using the AR system	81 (15% neutral)
Made class more interactive	86
Made class more interesting	71
AR System assisted me to contribute more in classes	74
Learnt more in class because of the AR System	61
Helped me gauge my understanding of the course	60
Allowed me to assess my progress relative to rest of class	70
Liked answering questions in class via the AR System	86
Helped me to concentrate more in class	58
Wish to use the AR system more	82

4.2 Adoption of Tablet Laptop Technology

Tablet laptops have been found to increase collaborative learning, and provide the academic with the opportunity to explore concepts digitally, rather than spend time drawing on the whiteboard (Toto et al, 2006). In a study by Biswas (2007), students also noted how the tablet laptop helped them to concentrate more on understanding the concepts of their topic, rather than spend time transcribing notes or copying drawings from the whiteboard.

Several academics use tablet laptops as a means of digital annotation. The benefits within specific disciplines are evident; for example in accounting where exposure to completing industry-standard templates and exploring financial calculations is essential. Using a tablet device permits the advanced preparation of materials for completion during class sessions. The approach simulates a 'real world' environment, with clear benefits, for instance a range of templates and examples can be provided to students electronically so they can work through these together without the need to spend time in note taking. Furthermore, the opportunity afforded through use of "real world" contexts is invaluable. Perhaps unsurprisingly introducing tablet laptops has led to positive outcomes for both staff and students, as summarised in Table 4 below.

Table 4

Quantitative Measures	Student Qualitative Feedback
95% enjoyed use of tablet laptop in class	"Buy one for all lecturers"
90% said using a tablet laptop helped the lecturer explain topics more effectively	"[The tablet laptop] Improved presentation of layout of written answers when answering a question"
77% thought tablet laptop benefited their learning	"Ability to switch from pre-prepared notes to written answer notes in class"
77% thought tablet laptop helped to maintain interest in the topic	"For some notes it makes the difference where lecturer can use different colours to explain the things in details"
74% said tablet laptop allowed lecturer to address topic more thoroughly	"More modern approach rather than 1950s chalk. Enabled lecturer to easily display explanations plus he could save these and put them on WebCT"
70% felt they interacted more in class	"Some slides prepared in advance gave lecturer more time to explain and add extra notes if necessary"
60% said laptop helped concentration on the topics	"Was a good modern take on OHPs which I found beneficial"
11% would prefer the use a chalkboard or OHP (**80%** disagreed)	"Templates were prepare and could be called up on screen quickly, did not run out of space or have to wipe information"

One participating lecture advised:

> "I teach 8 classes a week and I use the tablet for 6 of the 8 classes. My main use of the tablet is working through answers to accounting questions. I also use it to a lesser extent to show slides. Time taken to input into the notebook has noticeably expanded my working week. I feel I'm bettered organised than before and can use time in class more efficiently. The files I'm building up should save time in preparation in future years. I wish I'd had the tablet throughout my teaching career".

4.3 Use of 'screencast' Presentations

Increased student numbers and the ongoing demands to provide more time for tutorials presents the familiar challenge of "How can a lecturer optimise on the use of their class contact time"? As has often been the case in these situations, lecturers are forced to review the effectiveness of teaching methods. 'Screencasting' is a step forward from creating text-based notes incorporating a screenshot of the computer screen. Instead, the lecturer records their actual procedures on-screen into a video which can incorporate audio narration, slides, images and moving images. This approach has been applied effectively in a number of disciplines as well as in Library services, where students can watch tutorials outlining the procedures required to find and reserve books using the online Library Catalogue. Screencasting is used by academic staff in the School of the Built Environment, to provide students with self-contained video tutorials on the use of AutoCad. Over 500 students participate in the AutoCAD module, and by using Camtasia Studio screencasting software to create 'virtual' learning resources, the lecturer has removed a need to repeat lecture sessions three times

a week to accommodate all participating students. In addition, the lecturer has made these resources available to other academics within the School, eliminating their need to present the information via traditional lectures to their students, resulting in a further reduction of 6 lecture sessions per week. Now, all students participate in a uniform learning experience as they all receive the same 'lecture' content. The time initially allocated for lectures is now used to facilitate one-to-one 'drop-in' sessions where students who are challenged by specific aspects of the course can work through materials they find problematic with the lecturer. The course has recorded over 20% increase in its pass-rate, to almost 100%, when compared with previous years.

5. SUMMARY OF OBSERVATIONS

Too frequently authors report the positive findings of their work whereas we believe that it is by sharing those "What would you do different?" experiences that others can benefit most. Positive outcomes are cited above, based on basic qualitative and quantitative observations. Returning to the structural model and associated responsibilities the following observations are presented.

Table 5

Factor	Benefits	Areas for Development
Location of Responsibility	Linked to strategic responsibility for ICT procurement Independent of discipline area Promotes teaching and learning responsibility of an 'administrative unit'	Increase staffing complement of develop 'hybrid competencies' within existing team Extend focus to incorporate student-led initiatives
Inter-Faculty and Inter-Campus Activity	Encourages cross-discipline experience sharing Avoids 'silo of expertise' Cost-effective approach Creates 'balance' in pedagogical innovations and research	Opportunity to develop support within Faculty ICT support teams
Training and Advice	Ability to network and deliver a range of services based on need Provided by experienced teams; partnership between academic and technologist Administrative departments best able to manage 'one-to-many' style events Capability to 'tune' needs to academic's requirements	
Financial	Budget accommodates scale of current and anticipated activity	Retention of budget via encouraging further research-focused outputs

Related factual information that conveys impact and reinforces the small scale aspect is given in Table 6. The work, whilst relevant, highly beneficial and capable of generating 'results', nevertheless remains a niche activity, albeit a successful one. Financially, the perceived link between investment and outcome is important to be aware of for reasons given below. Communications within the complexity of the organization remains a challenge. Continuance of a proactive approach and the inclusion of additional effort from within ISD's current staffing complement are essential factors to address. Cultural change remains a constant challenge especially in an academic world where evidence-based research is often a mandatory prerequisite for change. For example, in 2007, an EDUCAUSE survey cited "Establishing and supporting a culture of evidence" as the "number 1" priority facing the educational environment (Campbell et al, 2007). These projects are considered to be pedagogically driven as opposed to technology led; however the omnipresent need to 'prove' benefits remains.

Table 6

Metric	Performance (over a 3 year period)
Number of Academic Staff participating	70 (5% of all academic staff)
Number of Students participating	>1600 (approx. 7%) >1000 for Audience Response System > 400 in classes involving use of tablet systems > 200 in classes associated with Camtasia
Increase in Audience Response System Handsets	>1000 (approx. 1700% increase); +500 in 2009/10
Communications	Monthly seminar series Approx. 25 Information Raising Events 5 Conference Papers and 2 Journal Articles Regular Articles in in-house Newsletters

6. CONCLUSIONS

The majority of feedback from students and staff has been positive to each technology discussed, although as already stated, the work has involved motivated academic staff. Effort required to initiate a collaborative venture with academics has varied from being academic led to promotional; this 'start up' cost is small however the worth of each project has been broadly dependent on the thoroughness of pedagogical design considerations, which can be substantial. Constructive pedagogical roles for technology are essential to identify and it is the opinion of the authors that such roles have been achieved. Student feedback has been in-the-main positive and the teaching experience they were subjected to was new, as was its delivery for their lecturer. Can the roles played by technology positively benefit the student experience? In our experience the answer is "yes" based on feedback received from participating staff and students. The introduction of small-scale ICT projects can aid learning, increase student motivation, development of new and relevant competencies for both staff and student, but only when the approach to introducing these new technologies is based upon pedagogic concerns rather than simply introducing something novel to the learning experience. The benefits of the technology for both staff and students need to be clearly outlined from the beginning of the project, rather than introducing a 'solution' to a problem which does not exist. Any new 'educational' technology is just a tool to aid the lecturer and the student – it is how they are used within the educational environment, with clearly defined roles and purposes, and clear pedagogic gains, which is key to their success.

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