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The Potential of a Methodology for University-wide Multimedia and Educational Technology Evaluation

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ABSTRACT *This paper reports on the methodology used for a review conducted at the University of Melbourne to determine the impact on teaching, learning and student study habits of multimedia and educational technology. Of particular methodological interest among the multiple components of the review was a quasi-controlled study of student attitudes towards and experiences of using educational technology. These were gathered using a targeted student sample comprising students known to have studied units in which well-established and highly peer rated IT products are deployed and a random student sample stratified to be representative of the typical student experience of the university. The paper reports the outcomes and effectiveness of this methodology.*

Introduction

Like many other universities, the University of Melbourne has given a high priority to providing all students with access to on-line educational services and a similar priority to transforming teaching and learning through the integration of multimedia and related educational technologies into curricula. This paper reports on the method and some of the findings of a recent evaluation of the overall institutional influence of multimedia and educational technology development projects on teaching and learning at the University of Melbourne.

What makes the study unusual is a methodology that involved a quasi-controlled study of student attitudes, using a targeted student sample comprising students known to have studied units in which well-established and highly peer rated educational technology products were deployed and a student sample stratified to be representative of the typical student experience of the university. As reported in this paper, comparison of the attitudes between the two student groups allows a number of conclusions to be drawn on the overall impact of educational technology in teaching and learning.

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The Centre for the Study of Higher Education (CSHE) conducted the investigation with a brief from the University of Melbourne to examine the overall impact on teaching and learning of multimedia and educational technology development projects funded through an internal competitive grants scheme. The review investigated a number of dimensions of 'impact', including the scope (the breadth of student exposure to new ways of learning), the extent to which project outcomes have become an embedded component of curricula and the nature of the influences on both teachers and students. The ultimate aim of this evaluative work was to identify and measure outcomes commensurate with the objective of the University of Melbourne of transforming teaching and learning and to provide a quantitative basis for future evaluation.

The Challenge of Measuring the Impact and Effectiveness of Educational Technology

A comprehensive evaluation of projects in Australian higher education that employed multimedia and educational technology in the mid 1990s indicated that student satisfaction surveys were the most common form of evaluation of such projects (Alexander & McKenzie, 1998). The findings from the current review indicate that this method of evaluation is still popular among staff employing multimedia and educational technology and that, on the whole, the feedback from student satisfaction measures is very positive.

But herein lies a well-known problem; student satisfaction surveys are unlikely to reveal whether learning has changed or improved because of the use of technology nor, indeed, whether learning is occurring at all. Often, satisfaction surveys, completed by students after they have used a product, are the principal or sole indicator used to make evaluative judgements. There is very often a confusion between student satisfaction and student learning and level of student enjoyment becomes a proxy for measurement of learning outcomes. As Alexander & McKenzie (1998) point out, although positive student attributes and increased motivation might encourage better learning outcomes, they are not in themselves evidence of improved learning.

The CSHE review aimed to go beyond this useful, but ultimately limiting, evaluation method. The review involved gathering and analysing data from multiple sources, including as the main element an undergraduate student survey of a random student sample and a targeted student sample. These were designed around a quasi-experimental methodology, as explained later, to avoid some of the limitations of satisfaction surveys. In addition, the review utilised:

- information provided by staff who had received multimedia and educational technology grants, including findings of their evaluations and any published papers and reports;
- analysis of existing University of Melbourne student evaluation of teaching data;
- comparison of the student survey findings with benchmarks from a recent national study of the first year experience (McInnis *et al.*, 2000);
- comparison of the survey findings with benchmarks from the University of Melbourne's annual graduate surveys.

These sources of data were used for a variety of purposes within the objectives of the review. The sources and their purposes are summarised in Table 1.

The focus of this paper is on the main element of the review, the student surveys. The findings from the other methods and data sources are not reported here.

TABLE 1. Summary of methods used to examine aspects of interest

Method/source of information	Aspect		
	Scope	Integration	Influence
Existing data			
Existing project type and distribution data	X		
Sudent evaluation of teaching data	X		X
Faculty strategic plans	X		
Grantee's existing reports, papers and datasets	X	X	X
New data			
Email survey of grantees	X	X	X
Interviews with selected grantees	X	X	X
Random student survey	X		X
Targeted student survey			X
Benchmark data			
First year experience data (CSHE)	X		X
Graduate survey data (CSHE)	X		X

The purpose of the review was to examine the overall uptake and impact of educational technology. It was essential, then, that the methodology employed could adequately measure these aspects of educational technology. The intellectual framework for the student survey instrument, the *Study Approaches Questionnaire* (SAQ) (see Appendix), used to measure student attitudes and experiences, allowed valuable new information on students' overall study habits to be collected, in addition to information on their patterns of use of multimedia and their perception of its effectiveness. This information includes:

- student expectations of study when they commenced at the University of Melbourne, compared with what they subsequently experienced;
- the academic and social use of the Internet and E-mail;
- students' overall attitudes towards and experiences of using educational technology;
- students' views on the effectiveness of various forms of educational technology;
- the extent to which students felt they received feedback on their progress;
- the extent to which students feel part of a 'learning community'.

The Development of a Quasi-experimental Methodology

Design

In order to determine the uptake and impact of educational technology among students at the university in a novel way, a quasi-experimental design, also called a non-equivalent control group design (Cohen *et al.*, 2000), was used. Two samples of students were drawn from the population of students at the University of Melbourne, a 'target' group and a 'control' group. All were second or third year undergraduate students. The survey was mailed to the students in March 2000.

The targeted group were 475 students known to have completed a single first or second year subject in 1999 in which the products from one of six highly peer rated internally funded multimedia and/or educational technology projects were used. These projects were deployed in a wide range of disciplines and most had had a sustained period of development, implementation and fine tuning. The response rate for this group was 27% (126 students).

The 'control' group consisted of 1000 students randomly selected from the student database and stratified by faculty. In order to ensure the random sample incorporated students who had had the wide range of exposure to and experience with multimedia that the population were likely to have had, students who had used the six products were not excluded from the population from which the random sample was drawn. Had they been so excluded, the random sample might have been skewed toward less experience with multimedia. In order to ensure that no student was surveyed twice, a cross-check between the 475 names in the targeted group was made with the 1000 names in the control group. The response rate for the control group was also 27% (270 students).

This design is referred to as a 'compromise design' (Kerlinger, 1970). As is often the case in educational research, it was not possible in this review to undertake a true experiment. Specifically, control over neither student level of exposure to multimedia and educational technology products and experiences nor over the randomisation of exposures were possible. The 'experimental' (targeted) and control groups used here could not be equated by randomisation, hence the term 'non-equivalent' mentioned above. However, the addition of the control group means that the design is an improvement on the one group pre-test/post-test design. Similarly, using samples from the same population helps to strengthen the equivalence of the groups (Cohen *et al*., 2000).

Validity

As well as through matching the control and targeted student groups as much as possible, the validity of the review was strengthened through:

- the use of an 'external' research team who did not have vested interests in the outcome of the review;
- the selection and use of appropriate instrumentation;
- ensuring the use of standardised procedures for gathering data;
- using appropriate statistical treatments for the data collected, where appropriate;
- as far as possible avoiding subjective interpretation of the data;
- avoiding making inferences and generalisations beyond the capability of the data (Cohen *et al*., 2000).

In total the review received 396 responses. The overall response rate is comparable with that which the CSHE is presently achieving with mailed surveys in which there is no follow-up of non-respondents. As usual, female students responded more strongly than males (female/male response ratio of 64 : 36, compared with 53 : 47 in the population from which the sample was drawn).

Survey Instrument

Students were asked to complete the *Study Approaches Questionnaire* (SAQ) (see Appendix), developed specifically for the project. While the project timeline did not allow for extensive piloting, the origins of the SAQ are owed to questionnaires with long and validated histories. The basis of the questionnaire included the *Approaches to Learning Survey* (Johnston, 2001), which in turn was developed from the *Course Experience Questionnaire* (Ramsden, 1991) and the *Attitudes to Study Inventory* (Entwistle & Ramsden, 1983). These questionnaires are well validated with Australian higher education populations. In addition, some items in the SAQ were drawn from the

extensive work by McInnis *et al.* (2000) on the first year experience over 5 years from 1994 to 1999. Finally, a small number of new items related to study habits were developed for this investigation. The questionnaire has strong content and face validity.

The instrument asked students to look back on their patterns of study in 1999. It focuses mainly on the availability, use and effectiveness of multimedia and educational technology, but it does so in the context of students' overall study habits. This approach was designed to provide the university with new insights into the typical student week on campus.

The Outcomes of the Method

The responses from the two groups indicate that the survey instrument performed well and that the quasi-experimental design was successful. Specifically, the method enabled a clear distinction between the experiences and attitudes of students who had higher exposure to educational technology and those in the control group.

Expectations of the Extent of Technology in Teaching and Learning Compared with the Reality Experienced

To begin with, it is notable that the amount of educational technology used in teaching and learning considerably outstripped student expectations. In the survey we asked students to report their 1999 experiences of study compared with their expectations when they commenced their degree. As Table 2 illustrates, students generally experience more technology-guided study than they had expected when they came to the university. In addition, and of considerable significance, while the students in the control and targeted groups were roughly similar in their prior expectations, the targeted students reported far greater actual exposure to technology-related learning of all kinds.

The two 'non-technology' control items listed at the foot of Table 2 boost confidence in these conclusions. For both these items, the targeted group's responses are very

TABLE 2. Expectations of study modes and the reality experienced

	'Expectation' (% expecting 'a good deal')		'Reality' (% experiencing 'a good deal')	
Study mode	'Control' students	Targeted students	'Control' students	Targeted students
Interactive multimedia software used in teaching and learning	28.7	28.8	46.2	56.1*
Web-based resources for study purposes	38.0	48.4	58.2	70.2*
On-line learning at my own pace	19.2	23.2	26.8	38.5*
On-line discussion with other students	10.6	11.9	7.3	18.7*
Collaborative study with other students	35.3	36.7	25.8	27.7
The amount of time I would have to spend on study	70.0	69.6	69.8	71.5

Percentage of students expecting and finding 'a good deal' derived by summing scale points 5 and 4 on a five-point scale.

* Statistically significant difference between control and targeted groups ($P < 0.05$).

similar to those of the random group, suggesting that responses to the technology items are unlikely to be the result of a 'halo' effect of some kind.

Usage and Usefulness

One-third of undergraduate students were regular users of multimedia in 1999, 57% reporting regular use of university web-based resources (Table 3). Once again, the targeted sample reported considerably more frequent usage rates: almost half were regular users of multimedia, while two-thirds were regular users of web-based resources.

The majority of students who are using educational technology believe it is useful in their learning (Table 4). However, their reactions are only moderately positive: 53% of the random group of undergraduates found multimedia useful or very useful, while 58% found web-based resources likewise. Significantly, the targeted sample of students reported much higher levels of satisfaction, 64% in both cases.

The 'exposure' findings in Table 4 suggest reasonable to good integration of multimedia and educational technology in the undergraduate curriculum. Using the figures for the random group, we can conclude that 70% of undergraduate students encountered multimedia at some point in their 1999 studies. An even greater proportion,

TABLE 3. Frequency of use of study mode

Study mode	Regular (daily or weekly) use (%)	
	'Control' students	Targeted students
Studied using subject specific multimedia produced by the University of Melbourne	34.0	49.6*
Used web-based resources and information designed specifically for the course	57.4	66.7*
Worked from home using the university Email and on-line material	38.5	46.4*

Percentage of students expecting and finding 'a good deal' derived by summing scale points 5 and 4 on a five point scale.
* Statistically significant difference between control and targeted groups ($P < 0.05$).

TABLE 4. Usage and usefulness

	Students who had used in 1999 (%)		Users finding useful/very useful (%)	
	'Control' students	Targeted students	'Control' students	Targeted students
Interactive multimedia software designed specifically for the course	70.4	92.1*	53.2	63.8
Web-based resources or information designed specifically for the course, accessed at university	82.4	93.6*	57.7	64.1*
Web-based resources or information designed specifically for the course, accessed from home	68.3	76.2	68.3	72.9

'Control' students, $n = 270$; targeted students, $n = 126$.
* Statistically significant difference between control and targeted groups ($P < 0.05$).

82%, used web-based resources while on campus. Both proportions are considerably higher for the target group, which approaches universal usage of both technologies.

Student perception of the effectiveness of these technologies, as measured in responses to 'how useful did you find the learning tool', is only fair to moderate for the random group; just over half the users of multimedia, for instance, reported they found it useful or very useful (Table 4). However, levels of satisfaction are again considerably higher for the target group.

Finally, the data in Table 4 also shows that two-thirds of undergraduate students accessed the university's learning resources from home at some time and, as Table 3 shows, 38% did so on a regular (daily or weekly) basis.

Student Attitudes Overall

The survey gave students the opportunity to indicate their agreement/disagreement with a set of propositions relating to their patterns of study, attitudes and overall satisfaction (Table 5).

TABLE 5. Student patterns of study, attitudes and overall satisfaction

	'Control' students (% agree)	Targeted students (% agree)
Multimedia items		
1 Multimedia and educational technology play a vital part in my learning	41.6	53.2*
2 I feel really confident using multimedia and educational technology for study purposes	49.6	54.8*
3 The multimedia and educational technology in my course have really captured my interest	28.9	32.8*
Other items		
4 The use of information technology in my course helps me to learn effectively	40.5	56.3*
5 The use of IT in my course provides me with helpful feedback on my progress	15.7	14.4
6 On campus, I am able to access information technology resources when I need them	51.5	54.8
7 I really only use computers for word-processing	29.4	19.2*
8 I mainly use email for social purposes and not for study	68.6	72.0
9 Lectures are a valuable part of my learning	84.6	85.6
10 I regularly study with other students	17.5	10.3*
11 I feel part of a group of students and staff committed to learning	47.4	57.9
Overall satisfaction		
12 I find my course intellectually stimulating	75.8	81.7
13 I receive appropriate feedback on my progress	34.0	33.3
14 Where it is used, information technology helps me to learn	52.0	65.9*
15 Overall, my study is enhanced by the learning materials provided in my course	74.7	76.2
16 Overall, I'm satisfied with the use of educational technology in my course	51.5	59.5*
17 Overall, I am really enjoying my course	75.5	76.2

% agree = percentage agreeing or strongly agreeing.

* Statistically significant difference between random and targeted groups ($P < 0.05$).

Some features of the findings in Table 5 are worth highlighting.

- The students in the targeted group are consistently more positive towards multimedia and related technologies than the random group (items 1–4, 14 and 16). They also tend to find their courses more intellectually stimulating, although not statistically more so (item 12).
- The positive reactions of the targeted group to technology do not show up in greater overall satisfaction; the two groups are almost identical in this regard (item 17).
- Despite the positive reactions of the targeted group to their experiences with multimedia and educational technology, they report no greater feedback on their progress than the random group (item 13) nor do they have a stronger belief that the use of IT provides helpful feedback on their progress (item 5). Only 14% of the targeted group said that information technology provides them with helpful feedback. This is a somewhat puzzling result, because feedback was repeatedly mentioned by students in their open-ended answers gathered in the wider review. Perhaps 'feedback' is being interpreted in different ways, at times to refer merely to letter grades on assessment.
- A very positive sign is the extent to which the targeted group believe they felt part of a group of students and staff committed to learning in comparison with the random group (58% compared with 47%, item 11). This finding suggests that the effective use of technology can support a sense of academic and social cohesion.
- However, such cohesion appears to be of a virtual kind as the targeted group also indicated a significantly lower level of regular study with other students than their random group counterparts (item 10). It is possible that regular study with others has been interpreted by respondents as traditional face-to-face study only and has excluded the ways in which students might work 'together' on-line. However, this is a speculative interpretation.
- Most students appear to use E-mail mainly for social purposes (item 8).
- From the student perspective, lectures remain a highly valuable component in their learning (item 9).

Does the Evaluation Method have Wider Applicability?

This paper indicates that the quasi-experimental methodology employed has potential in contributing to the measurement of the impact, scope, influence and extent of embedding of educational technology in university teaching and learning. These outcomes are abstract and difficult to quantify, yet the methodology was successful in differentiating between the experiences of students who had less and more exposure to multimedia and educational technology.

At the outset, the hope of uncovering potential differences between a control and targeted group was ambitious, since all University of Melbourne students have significant exposure to various forms of technology. However, important differences were detected between the groups that lend some support to both the educational effectiveness of educational technology and to the method through which these differences were uncovered. Since the study's control group was a truly random group, chosen without regard for the subjects students had completed, it doubtless included students who had experienced various multimedia and educational technology initiatives, probably some who had used the targeted products. This makes the differences identified between the random and targeted group, and the potential of this method, all the more convincing.

It should be noted that students' experiences of multimedia and educational technologies are diverse and dependent on their faculty, year level and chosen subjects. Any sampling procedure can overlook important outcomes under these circumstances. Yet despite these possible limitations, the quasi-controlled study was an effective method in the context of the review. The response rates were acceptable, and could be enhanced with mail and/or telephone follow-up. The control and targeted groups returned statistically significant differences in student attitudes and study habits.

The control/targeted method places the university in a position to make important comparisons and to draw significant conclusions. On the one hand, the random student sample permits conclusions to be drawn about the typical student experience in 1999. On the other hand, the targeted sample allows the university to look for differences, if any, between 'typical' students and students likely to have had greater exposure to high quality, successfully embedded multimedia and educational technology project materials.

The responses gathered through this method make it clear that multimedia and educational technology are valued by students, but not for the technology itself. Rather, it is for the core aspects of good teaching that can be captured by these resources. Students appreciate feedback on their progress. They appreciate being engaged with ideas. This is an excellent reminder for the university of its core objectives in transforming teaching and learning.

The responses of the targeted group also highlight the impact on the student learning experience of well-designed and well-integrated applications of educational technology. They also show what might be possible to achieve for all students. The figures for the targeted student group are realistic aspiration points for the University of Melbourne and may prove useful as benchmarks for other universities.

While the targeted students' reactions to the use of technology are generally positive, they report no higher levels of overall feedback and no greater satisfaction with their courses. There is an indication, however, that higher levels of technology exposure are associated with a greater sense of belonging to a staff/student learning community and a stronger belief that courses are intellectually stimulating. If this is indeed the case, then this is a valuable outcome from the use of educational technology. Clearly, such a finding needs further testing and the quasi-experimental method outlined here would seem to have potential for such further investigation.

Conclusion

The findings of the review, including those from the methodology discussed in this paper, have led the University of Melbourne to consider whether or not the key characteristics of effective multimedia and information technology projects can be identified and redeveloped in new settings.

It is clear that systematic, university-wide evaluation of the impact of multimedia and educational technology can provide some indication of improved student learning, but much more work needs to be done in this area. Research of this kind is painstaking and requires careful measurement of the preconditions. Most importantly, evaluative techniques must validly and reliably reveal gains in learning.

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Appendix

Excerpts from *Study Approaches Questionnaire*

This questionnaire asks you to look back on your course and your approaches to studying last year. We are interested in your use of information technology during a typical study week.

The survey is motivated by the rapid transformation in approaches to learning created by multimedia and other forms of educational and information technology. To manage these developments effectively, the University needs to monitor what students are finding most and least effective.

The questionnaire takes less than 10 minutes to complete. Your responses will be totally anonymous.

Gender: Faculty/course: Year of study:

How do your experiences so far at the University of Melbourne compare with what you expected when you commenced your degree? (Please circle appropriate response)

	How much did you expect? A good deal ↓				None at all ↓	*In reality, how much?* A good deal ↓				None at all ↓
Interactive multimedia software used in teaching and learning	1	2	3	4	5	1	2	3	4	5
On-line learning at my own pace	1	2	3	4	5	1	2	3	4	5
On-line discussion with other students	1	2	3	4	5	1	2	3	4	5
Web-based resources for study purposes	1	2	3	4	5	1	2	3	4	5
Collaborative study with other students	1	2	3	4	5	1	2	3	4	5
The amount of time I would have to spend on study	1	2	3	4	5	1	2	3	4	5

Your use of multimedia and educational technology:

Please indicate how often you	Daily	Weekly	Irregularly	Never
Worked with other students on course areas with which you have problems	1	2	3	4
Got together with other students to discuss subjects/units	1	2	3	4
Used the university email system for study purposes	1	2	3	4
Used on-line discussion groups	1	2	3	4
Worked from home using the university email and online material	1	2	3	4
Studied using subject specific multimedia produced by the University of Melbourne.	1	2	3	4
Used web-based subject homepages with resources and information designed specifically for the course/subject	1	2	3	4

How useful have you found the following educational tools within your course?	Very useful ↓				Not at all useful ↓	Have not used ↓
Web-based resources/information designed specifically for your course, accessed from home	1	2	3	4	5	☐
Web-based resources/information designed specifically for your course, accessed at university	1	2	3	4	5	☐
Interactive multimedia software designed specifically for your course	1	2	3	4	5	☐
On-line discussion groups with other students	1	2	3	4	5	☐
'Virtual tutoring' (electronic access to tutoring support)	1	2	3	4	5	☐

	Strongly agree ↓				Strongly disagree ↓
Multimedia and educational technology play a vital part in my learning	1	2	3	4	5
On campus, I am able to access information technology resources when I need them	1	2	3	4	5
I feel really confident using multimedia and educational technology for study purposes	1	2	3	4	5
I mainly use email for social purposes and not for study	1	2	3	4	5
Lectures are a valuable part of my learning	1	2	3	4	5
The multimedia and educational technology in my course have really captured my interest	1	2	3	4	5
I regularly study with other students	1	2	3	4	5
The curriculum is innovative and forward-looking	1	2	3	4	5
I feel part of a group of students and staff committed to learning	1	2	3	4	5
The use of information technology in my course helps me to learn effectively	1	2	3	4	5
I really only use computers for word-processing	1	2	3	4	5
The use of IT in my course provides me with helpful feedback on my progress	1	2	3	4	5
I find my course intellectually stimulating	1	2	3	4	5
I receive appropriate feedback on my progress	1	2	3	4	5
Where it is used, information technology helps me to learn	1	2	3	4	5
Overall, my study is enhanced by the learning materials provided in my course	1	2	3	4	5
Overall, I'm satisfied with the use of educational technology in my course	1	2	3	4	5
Overall, I am really enjoying my course	1	2	3	4	5

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