

# Capitalizing on the educational research output of an institution: a grounded analysis of evaluation studies

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**Abstract:** This paper reports on a meta-evaluation of 84 papers on ICT in education produced at the University of Melbourne. A grounded approach was used to develop a comprehensive classification framework of phenomena emerging from the papers, rather than attempting to fit them within any pre-existing learning or evaluation model. The classification framework has been made available through an online database, enabling University staff to access publication 'profiles' of faculties, groups, or individuals; survey educational initiatives and evaluation approaches; and list key findings and issues raised by their peers. This grounded review process has been proposed as a key component of the University's long-term evaluation strategy plan, to enhance monitoring of trends and dissemination of evaluation findings. The grounded review process, key findings, emergent classification framework and online database instrument are described and implications for the improvement of learning and teaching discussed.

## Introduction

Over the past five years the University of Melbourne has invested approximately \$12M in some 240 curriculum initiatives across all discipline areas, representing diverse educational requirements, approaches and outcomes. While many project evaluations have been undertaken, these tend to be reported within different forums to specialized audiences and remain difficult for others to access. The question remains: how can the University, through its teachers, researchers and managers, reflect on and learn from this strategic knowledge and experience it has invested in?

In 2002, a meta-evaluation of academic papers on ICT in education produced at the University was undertaken on behalf of the Teaching & Learning (Multimedia and Educational Technology) Committee (Fritze, 2002). Its purpose was to inform a comprehensive evaluation strategy to determine the impact of educational technology related projects and follows from earlier broad scale reports focusing on the student experience (James, 2000). While the initial interest was on the evaluative aspect of papers, it was clear that broader knowledge of the educational initiatives, their settings and the connections between initiatives, groups and individuals was required to contextualize the studies and to uncover trends and unexpected issues that could inform strategic policy. Further, the review also provided an opportunity to create a unique resource for teachers in the form of the collated research outcomes of their peers that could be made accessible through an online database. The grounded review process piloted in this review has been proposed as a key component of the University's long-term evaluation strategy plan, to enhance the monitoring of trends and dissemination of evaluation findings across the University.

While this evaluation project is focused on supporting the University of Melbourne teaching and management community, the review process and findings from it will be of interest to other institutions.

## Methodology

In late 2001, Melbourne University teaching staff were invited to submit papers to be included in the review, resulting in a sample of some 84 papers, including 43 conference papers and 23 journal articles. Full analysis was undertaken on 57 papers, with the rest appearing within the basic publication statistics. While these papers do not

represent the full institutional research output and were unevenly distributed across discipline areas, they provide an indication of trends and contribute to an important pilot project from which a larger scale review will be undertaken in 2003.

A grounded analysis approach was used to identify factors emerging in the papers themselves, rather than attempting to fit these data against any existing evaluation or organizational model (Glaser & Strauss, 1967; Strauss & Corbin, 1998). This methodology enabled the management of a large body of complex information, yet provided a level of relevant detail to reveal individual experiences, patterns of use and unexpected issues.

The process of grounded analysis involved reading each paper thoroughly, reflecting on what the writer seemed to be saying, marking statements that seemed significant and noting tentative descriptive labels. These labels were gradually organized into more robust categories and sub-categories consistent across the papers. As the categories formed, key statements were recorded using, as far as possible, the wording of the authors. A database was used to record the categories and descriptions, making it possible to quickly review and refine entries. During the analysis, categories and dimensions were at times revised or merged as the framework was tested against new papers and re-tested on previous ones. A deliberate process of 'theoretical' sampling was used to consolidate emerging themes or expose new lines of investigation (Strauss & Corbin 1998).

This pilot review was undertaken by the author alone, although in the normal course of such an analysis, other reviewers would be drawn in to verify and consolidate the findings. It is the nature of such a grounded analysis that the investigation will also be extended to reflect new data and changes in understanding. This openness to change is both a strength and weakness of the approach, but it is particularly suited to making sense of complex and evolving learning and organizational environments. The need to balance such studies with other methodologies is noted.

## **Key findings emerging from the review**

Key themes and issues emerging in the analysis were drawn together in the body of the report and are briefly summarized here.

A range of evaluation purposes and approaches was evident across the papers. Project reviews and formative evaluations were most common, but these were complemented by investigative analyses of targeted issues and broader program evaluations. A balance of such evaluation approaches was apparent within certain institutional areas, but was absent in others. Evaluation activity also ranged considerably in depth, from simple descriptions, to comprehensive, triangulated research studies. It is worth noting that, while descriptive papers may have questionable status as 'evaluations', they may still usefully inform others of works in progress.

Three generalized evaluation and production strategy models characterized different faculty cultures evident across the University:

1. The 'Medical' model - a strong centralized unit of educational designers, evaluators and developers supporting teachers and setting clear guidelines for production and evaluation.
2. The 'Economics and Commerce' model - characterized by large student numbers and standardized educational designs. A small faculty support unit coordinated generic approaches, assisted teachers and undertook program evaluations.
3. The 'Arts' model - characterized by small class sizes and face-to-face teaching. A central unit organized incentives and guidance for teachers to introduce basic technologies into their local teaching, often using action research and collaborations between teachers.

Objective measurement of actual learning outcomes appeared difficult to achieve, with the findings suggesting they varied from modest to ambiguous. Indeed, most common benefits reported related to value as perceived by students, rather than more definitive evidence. The majority of problems reported related to the integration of initiatives into the curriculum and dealing with the expectations and approaches of students, more than to technical or staffing issues. Where project evaluation sought to examine variability in effects on students, the findings indicated that some students adapted well to changing educational models, while others had difficulty. Common reported

problems included students not managing their learning, not using the resources as expected, technical problems, workload and seeing technology as a 'distraction'. These outcomes were not simply related to the use of technology, but reflected significant transformation in curriculum approaches in which both students and teachers had to adapt to new understandings.

There was evidence that undergraduate students and teachers were being exposed to issues at the forefront of discipline knowledge, as a direct result of the implementation of new ICT-based learning designs. This is a critical connection to be exploited in a research-focused teaching institution, such as the University of Melbourne. For example, in language learning, the use of ICT in learning was actually impacting on the cultures under study, in ways not yet understood by the discipline (Debski, 2000). Teachers are also adopting systematic and collaborative approaches to research into their own teaching in some areas (Debski, 2001).

The report suggests that significant institutional benefit will result from coordinating, at various levels, the focus of evaluations and providing an effective mechanism for disseminating the knowledge gained. Such knowledge comes in a wide range of forms of interest to different stakeholders. Further, it is observed that evaluations being undertaken on a project-by-project basis and reported through traditional academic publications do not appear to address some highly pertinent questions, such as implementation costs and impact on staff workload, despite these being clearly raised in other forums (Fritze, Canale, Cunnington & Smyth, 2001). Clearly factors such as these cannot be divorced from the University's overall understanding of the influence of ICT on teaching, learning and the quality of the student experience.

## **An emergent classification framework for the use of ICT in education**

The classification framework derived from the grounded analysis provides a profile of the substantive content within the set of papers examined. This was organized under the broad areas of publication details, initiative investigated, evaluation undertaken and findings reported. Under each area, different categories emerged, each associated with between one and 37 dimensions. The framework provides a powerful index to the papers, used as a front end to an online database (Figure 1). The main areas and categories emerging from the analysis are outlined below. Note that individual papers may not use the same terminology as the framework. The grounded categorization process required a pragmatic interpretation of meaning emerging within all papers, but these emerging definitions remain open to discussion and debate.

### **Publication details**

Publication categories are primarily straightforward information about the author(s), faculty, year, publication type, publication name, status (published, unpublished, etc.) and funding sources. Although most were published papers, some internal and external reports and staff development materials were also processed. Of interest is the 'Group' category, which identified particular networks of individuals who appeared to form interest groups collaborating across a number of papers. Such groups may exist outside the regular institutional structure and are often invisible to others; nonetheless, they are potentially a valuable source of specialist expertise and knowledge.

### **The innovation/initiative**

The types of initiative examined in the papers could be classed as courseware tools, curriculum innovations, development methodologies, strategic planning or teaching approaches, that is, not all papers were about curriculum 'products'. The 'structure' of initiatives varied from Web products, generic tools, CD-ROMs, staff development resources, to delivery mechanisms. Other categories here more broadly described 'originating work' underpinning the initiative and the issues it was responding to.

One particularly important category describing the initiative identified its key educational 'elements' (Table 1). For example, the most common educational features reported were labeled as 'PBL' (Problem Based Learning approaches), 'immediate feedback' and 'cognitive tools', reflecting a strong contribution from the Medical Faculty. At the other end of the scale, research-orientated student activities ('research') and 'student conference' activities were elements referred to in only single papers, but are still of potential interest to teachers. Most papers involved multiple educational elements. This category provides a useful index of current educational directions occurring in

the University.

<b>Educational element</b>	<b>Definition of term</b>	<b>N</b>
<b>PBL</b>	A Problem-Based Learning approach.	16
<b>immediate feedback</b>	Use of immediate feedback to student by interactive packages or other learning tools.	13
<b>cognitive tools</b>	Tools for students to practice/express their 'knowledge constructions'.	12
<b>reflection</b>	Reflection on learning by student within a course, possibly facilitated by learning tools	11
<b>resources</b>	Optimized access to discipline resources, e.g. databases, print resources or Web links.	11
<b>visualization</b>	Optimized illustration of discipline-specific concepts, e.g. through images, animations.	11
<b>authentic contexts</b>	Locating the learning activity within a real-world setting, or some approximation of it.	9
<b>group work</b>	Learning activity formally involving a group of students working together.	9
<b>SDL</b>	'Student Directed Learning', in which the student takes a degree of responsibility over what, when and how aspects of the curriculum are learned.	9
<b>administration</b>	Administrative support for teachers, e.g. organizing classes or materials, contacting students.	8
<b>CMC</b>	'Computer Mediated Communication', e.g. email, discussion lists, learning systems.	8
<b>collaboration</b>	Student activities involving some collective output, shared responsibilities, negotiation.	8
<b>lab simulation</b>	A working simulation of real life object, e.g. a laboratory instrument.	8
<b>peer feedback</b>	Learning activity in which student receives feedback on their work from other students.	8
<b>quiz</b>	Banks of short questions for testing or practice, possibly with answers or feedback.	7
<b>immersion</b>	Used in language learning, when the language being learned is used for all aspects of a activity and discussion with others. Arguably related to 'authentic context'.	6
<b>international</b>	Activities making use of on external contact e.g. 'exchanging emails with partner students'.	5
<b>learning management</b>	Strategies and/or tools designed to support the student in managing their own learning activities.	5
<b>role play</b>	Students adopt specific roles in an activity providing alternate perspectives on a situation.	5
<b>media</b>	Use of images, audio or video to enrich the learning environment.	4
<b>project oriented</b>	A teaching strategy where students learn diverse skills by undertaking an major project.	4
<b>authoring</b>	Environments for which teachers can 'author' their own learning resources e.g. quizzes.	3
<b>guest expert</b>	Students provided with access to views of external experts, e.g. live, online, recordings etc.	3
<b>presentation</b>	Strategies and tools to improve lecture presentations, e.g. 'video streaming of lectures'	3
<b>publishing</b>	Student activities involving preparing and publishing materials, e.g. as a Web site.	3
<b>field trips</b>	Visits by students to real-world sites, e.g. field trips to farms.	2
<b>individualization</b>	A particular focus on meeting the different requirements of individual students.	2
<b>simulation</b>	An activity that simulates a social environment in which students can engage.	2
<b>student support</b>	Mechanisms for providing students with access to ICT or educational advice and support.	2
<b>teacher support</b>	Mechanisms for providing teachers with ICT or teaching advice, resources or training.	2
<b>concept mapping</b>	The use of concept maps within student learning activities.	1
<b>project mgt</b>	A development strategy used by staff for managing projects.	1
<b>research</b>	Involvement by students in 'research-orientated activities'.	1
<b>self assessment</b>	Students provide an assessment of their own work.	1
<b>student authoring</b>	As a learning exercise, students create teaching resources for later use by other students.	1
<b>student conference</b>	A major project activity for students to set up and run a conference or seminar.	1
<b>virtual reality</b>	An engaging simulated environment that can shift the sense of place of the user.	1

**Table 1:** Educational 'elements' emerging from the grounded review of 57 papers (N=number of papers).

### **The evaluation/investigation**

The purposes of the evaluations varied from formative evaluations or reviews of product developments;

investigations into specific educational issues, such as student technology anxiety (Lewis & Atzert, 2000); to broader program evaluations. Other evaluation categories classified the methods used (for example, action research, quantitative, or case study); the sources of data; who carried out the evaluation (for example, teacher, student, or evaluator); and the subject(s) of the evaluation. Not all evaluations were into student learning alone, with some also examining the experiences of teachers or tutors.

### **Findings and impact**

The key findings and impacts were organized under the broad categories of:

*Benefits to learning* - concrete improvement(s) to student learning confirmed by evidence;

*Benefits to teaching* - concrete improvement(s) for the teacher confirmed by evidence;

*Problems identified* - problem(s) experienced;

*Impact* - based on evidence, area(s) in which the initiative had impacted, for example, across a department or faculty;

*Potential* - judgment that the initiative could have a wider impact, for example, across the university; and

*Issues raised* - issues of general interest to the University.

For any benefits to be acknowledged within the analysis, these needed to be supported by some degree of evidence. Potential for further use of an initiative and the issues raised were more subjective judgments, based on the researcher's judgment as well as evidence presented in the papers. The specific dimensions associated with each of these finding categories are indicated in Figure 1.

### **ICTweb: an online evaluation publication database**

The above classification framework was used as the basis of an online resource for teachers, managers, researchers and support staff of the University ('ICTweb'). The database provides three views of the review data: profiles of selected papers (Figure 1), listings of key extracts (Figure 2) and full summaries of individual paper reviews. The database in pilot form is accessible at <http://osx.meu.unimelb.edu.au/ICTweb/>.

The ICTweb page in Figure 1 shows the 'profile' of all 84 papers mapped by their categories and dimensions. The number of papers associated with each dimension is indicated in brackets. For example, there is one book chapter and 36 educational conference papers in the full group of papers. Clicking on any dimension number will return a profile on that subset of papers. Thus, profiles of faculties, educational approaches, problems, or indeed any dimension can be extracted. In addition, a search facility enables specialized profiles to be generated. For example, searching on an author's name will provide a profile of that author, summarizing their publications, types of initiative, evaluation approaches and key findings.

From any of these mapped profiles, a listing of information about the publications, initiative, evaluation or findings can be generated by clicking on the appropriate menu item in Figure 1. For example, in Figure 2 the 'Findings and Impacts' view from a profile of all papers in 'Engineering' is shown, listing the identified benefits to teaching and learning, problems reported and issues raised by researchers in that faculty. These few Web pages provide the basis of powerful mechanism for analyzing the evaluation research of academics at the University, as discussed below.

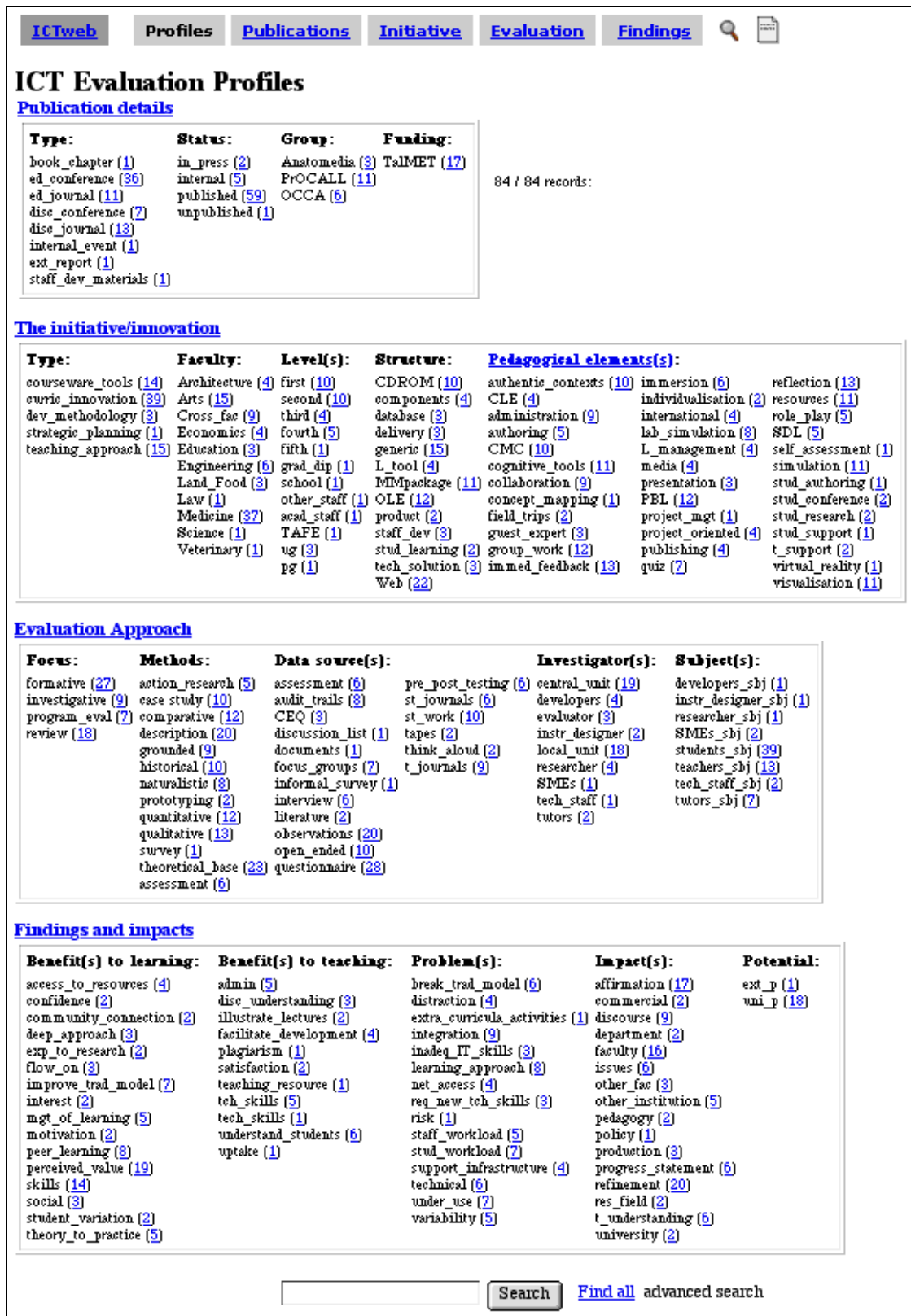


Figure 1: ICTweb page showing the categorization profile of all papers in the analysis.

The number of papers linked to each dimension is in brackets.

<p><b>Benefits to learning:</b></p> <p><b>2:</b> "overall, students expressed positive responses towards the introduction of the hardware into the course, and were appreciative of the opportunity to apply the theory that they had learned".</p> <p><b>3:</b> feedback from the Mechatronics projects exceeds faculty-wide norms by a significant margin."</p> <p><b>29:</b> "a positive aspect of the conference was its ability to reach out to the community".</p> <p>"students generally came away from the project with a number of skills that could transfer to other situations".</p> <p>"Many students felt a greater sense of camaraderie and got to know each other much better ... clearly a great deal of pride over the way it turned out".</p> <p>"students make good use of templates from previous years".</p> <p><b>44:</b> "all students agreed that "these web pages would help my understanding of Neighbourhood Regions"</p> <p><b>Benefits to teaching:</b></p> <p><b>3:</b> "easier and more flexible maintenance for the developers".</p> <p><b>36:</b> "I am convinced that this [the web conference rather than direct email] is the preferable way from the staff perspective of the most efficient way to manage this type of communication ... more easily accessible to the whole class".</p> <p>"the use of reflective diaries has provided a useful insight into student learning and can alert staff to problems that need to be rectified at an early stage".</p> <p>"...reductions in time spent photocopying and printing ... organising class lists and groups and delivering content ... are all real"</p> <p><b>Problems identified:</b></p> <p><b>2:</b> "general consensus amongst the students that the project work required too much time to complete successfully". "Significant also in all the journals was the amount of time spent by students in completing assignments... represents a considerable assignment workload in a subject that has a scheduled contact of two hours per week".</p> <p>"students expressed frustration at any technical difficulties that arose from the hardware or software not functioning as expected".</p> <p>"most of the students involved in this project chose to postpone their use of the equipment until as late as possible in the semester".</p> <p><b>29:</b> "workload it put on us [the facilitators] ... overwhelmed at the quantity of details that required our direct attention"</p> <p>"our key concern about the conference project was the somewhat uneven distribution of student workloads".</p> <p>"high risk approach that mounting a student conference entails"</p> <p>"Challenge of adopting to an unfamiliar style of learning" was a point repeatedly raised by students.</p> <p><b>36:</b> "many students find the size of the project daunting". "at present it arguably does take extra time, however this is partly as a result of adjusting working habits to a web based delivery culture".</p> <p>"the [teacher's] assessment load has increased ... due to the addition of the reflective diary component."</p> <p><b>Contribution:</b></p> <p><b>2:</b> "serves as another demonstration of the feasibility of Web-based access to physical hardware for the teaching of undergraduate control ... shows the positive student feedback to such initiatives".</p> <p><b>3:</b> "features will soon be added to the Telerobotic system..." "the Department has created a number of useful mechatronics tools".</p> <p><b>Issues raised:</b></p> <p><b>36:</b> "As with any new approach there has been an investment [by staff] in learning new skills and analysing and understanding new learning interactions". "The more important aspects are the ongoing operational time costs."</p>
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Figure 2: Online database listing key findings from 6 papers from the Engineering Faculty.

## Implications of the grounded review process on teaching and learning

The ICT evaluation review process outlined in this study provides a strategic instrument for the University community, serving different purposes for innovators, mainstream teachers, managers and support staff at faculty and central levels. At the heart of it is the emergent classification framework that consolidates a common terminology for community discussion, drawn from the research output of the community itself. This also provides a structure for academics to consider when preparing a research paper.

Trends, unexpected issues and profiles of faculties or individuals are revealed at a level of detail that can usefully inform management policy. The review process therefore adds value to the institution's investment in strategic curriculum programs and academic research. For example, listings of issues and problems raised by researchers can be placed directly in front of management committees to inform strategic policy.

Efficient access to the contemporary evaluation findings provides opportunities for enhancing teaching practice through sharing of educational approaches, resources and experiences. In addition, ICTweb can facilitate teachers adopting an 'evidence-based' approach to teaching, by enabling them to efficiently draw on the findings of their peers. Summary findings of a faculty-specific list of problems and issues might also provide a key resource for professional development workshops in that discipline. The scope of the resources reviewed can be extended to include summaries of seminars, unpublished reports, or even staff development materials. In this way, a common front-end to diverse information can be provided.

One unexpected outcome of this review has been to give innovators a profile in the wider community that renders their areas of interest, approaches taken, collaborations and contribution. This provides increased opportunities for

networking and collaboration across departments, disciplines and even institutions. The 'peer-reviewed' profile will also provide evidence for a teaching portfolio, far more meaningful than simply the number of publications.

## Discussion

Grounded analysis is an approach to organizing information in areas characterized by change and evolving communities, where common terminology, methods and roles have not been established (Fritze, 2003). This study has shown how such an analysis of reports and publications in the University has the potential to provide detailed profiles of ICT initiatives and evaluations, enabling the University to monitor contemporary trends and, importantly, be alert to unexpected issues and outcomes. This 'bottom-up' view would need to be complemented, however, with data from other investigations of the student learning experience. Triangulation of data from a number of sources is necessary if a University is to have a sound information base on which to shape policy and inform curriculum design.

Current work on this project are focusing on consolidating the review methodology as a credible and sustainable 'academic' process for reviewing the publication output of the University, centering on the interests of the local educational community. The work is supported by the Teaching Learning and Research Support Department and guided by the Teaching and Learning (Multimedia and Educational) Committee. While the formal support of the institution will be critical for implementing the review process and information system on a wider scale, it is important that academic community members contribute to the peer review process on behalf of their community.

Collaboration with other institutions is being sought in the use of this community-based review process to generate strategic opportunities for networking, collaborations, as well as the sharing of resources, teaching techniques and academic experiences.

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