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INTRODUCING TEACHING TECHNOLOGY AT TERTIARY LEVEL A PARTICIPANT CASE STUDY

by

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ABSTRACT

Whilst most tertiary institutions are cognizant of the potential of teaching technologies such as Computer Managed Learning (CML) for educational management and efficient student assessment, few have adopted a coordinated campus-wide approach to its introduction. Reasons identified include:

- the high establishment cost of infrastructure to support this technology
- the lack of documented cost/benefit analyses of such wide scale adoption
- some educators' and administrators' philosophical stance and attitudes on the use of computer-based teaching technologies
- the difficulty of obtaining campus-wide agreement on an implementation model, and
- the associated issues of standardizing on development and delivery software and hardware for the CML system

Problems are exacerbated when the implementation must include delivery to students studying on-campus, at branch campuses (in towns away from the main campus) and at a distance.

This paper provides a case study discussion of the process adopted by a Working Party established to advise on the wide-scale introduction of CML at a tertiary institution. It details this process from the initial working brief to the University's Academic Board's final acceptance, in principle, of the Working Party's recommendations.

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Introduction

The discontinuance of the binary system in higher education (Dawkins, 1987), required Colleges of Advanced Education such as Capricornia Institute (now the University College of Central Queensland, UCCQ) to adopt a profile that contained an increased emphasis on postgraduate course offerings and research output. To date, however, there has been no real increase in funding to assist these major changes in direction.

With this changing emphasis towards research and postgraduate based activities, institutions such as UCCQ have begun to seriously consider mechanisms to provide staff with the necessary time and funds so that they could pursue these activities. One such mechanism is to improve teaching efficiency and effectiveness. Teaching technologies such as CML were perceived as having the potential to achieve this.

Tertiary institutions in Queensland and elsewhere in Australia, have successfully utilized CML for educational management and efficient student assessment (Carss, 1987; Crock and Timmins, 1988; Stanford and Cook, 1987a). In the past, UCCQ had successfully utilized CML in some subjects, notably the P-Maths CML system (Clayton and Smith, 1984) for the administration of a continuing education bridging mathematics course. However the UCCQ senior management sought to determine the efficacy of wide-scale introduction of CML at the University.

In April 1989 the UCCQ Vice Chancellor established a Working Party on CML, hereafter referred to as the Working Party, comprised of the authors to advise on this proposed introduction of CML. The Working Party's brief was:

- to determine whether or not there should be a wide scale introduction of CML, and if so
- the academic, financial, and equipment implications of the preferred CML system,
- to determine the development pathway for CML introduction,
- to review existing commercial and institution generated CML systems,
- to determine the feasibility of developing an in-house CML system, and
- to determine how to advise staff seeking to change methodologies from a teaching-based system to a student learning-based system.

Answering the Brief

Taking a systems analyst's perspective to introducing any new computer based system, the Working Party adopted an investigative model that firstly defined the aims and scope of the project. Next, initial information on user requirements, basic resource requirements, constraints, possible solutions and some idea of projected costs and benefits were determined. Then recommendations on how to proceed to the next stage were then provided to management for their consideration.

Users Needs

For a brief such as the above an approach to use is to hire an external consultant. This would require as a first step for the external consultant to become familiar with the operations of our institution prior to performing a needs analysis. Instead the approach taken was for the Working Party members to serve as consultants. The Working Party had the advantage of already having some of this knowledge, however to fully specify users' needs, a series of "public" meetings were called at the University to provide information to identified groups of CML users and to gather information from these groups. Separate meetings were held for:

- academic staff,
- deans and heads of departments,
- students, and
- administrative staff.

Staff and students were also invited to provide written submissions concerning their views on and needs for CML.

The outcomes of these meetings were, on the whole, quite positive, with academic staff responsible for large classes keen to receive, at the very least, some automated marking assistance. However, there was comparatively little interest expressed in more complex CML systems in which automatic marking is integrated with the updating of the Students' Records system. This was interpreted by the Working Party as due to lack of imagination, caution or unfamiliarity with the concept.

Concerns expressed by academic staff in using CML included: test banks were often limited to multiple choice questions (some staff were simply philosophically opposed to using this form of assessment); possible problems with cheating and security; increased hardware requirements; uncertainty as to whether time would actually be saved; impersonalisation and the effect on the flexibility of the teaching/learning process; and the cost of implementation.

Staff who had previously been involved in CAL projects on campus considered that funding support was needed before they were prepared to be involved in any further computer-based teaching technologies. The following comment reflected this view.

"I was initially enthusiastic about using computers in my Biology teaching and helped to get the first set of multiple choice questions onto the Apples in the study centres. I subsequently had my enthusiasm sapped because of a series of difficulties....

We have to develop a total CML environment. We seem to get software without hardware or visa-versa. I could be enthused again if:

- My students could get ready and easy access to hardware....
- There was a suitable authoring environment....
- There was some support (relief) and recognition for staff prepared to be involved" (Newby, 1989).

Students implicated cautious interest in CML, in particular with regard to the flexibility it might allow for self-paced tests and working at home as reflected in the following comment.

"Sometimes you feel stifled by some people (students) who are going slower than you. With a computer you can go through the work yourself" (UCCQ Student, 1989).

Some students, however, were concerned that there might be a negative effect of reduced face-to-face contact with staff.

Development and Delivery Needs

In its preliminary brief the Working Party examined CML systems used elsewhere and in the process identified system parameters that needed to be taken into consideration in the selection of an appropriate CML system for UCCQ. It was seen by the Working Party that the system needed to

- interface with the existing Students' Records system resident on an HP4800,
- operate at various levels of sophistication, from a simple level of administering and marking one or two semester tests, to a full system which completely managed a subject including advising students of learning objectives, directing students to learning resources and activities, and administering and marking both formative and summative assessment tests,
- include test bank authoring facilities that would allow for creation of not only text based questions but also those containing graphics and complex mathematical and scientific formulae.

Furthermore, the system to be adopted would need to be able to be accessed by on-campus students, students studying at branch campuses at Bundaberg, Mackay, Emerald and Gladstone, and by distance education students.

Report Recommendations

In October 1989 the Working Party presented the final report to the Vice Chancellor (Clayton et al, 1989). The report concluded that CML, in general, provided a powerful mechanism for addressing such issues as the utilization of human resources particularly regarding the release of academic staff from administrative teaching chores, support to students studying in both on-campus and in distance learning modes, increasing learning effectiveness and the testing and administration of subjects with large (greater than 100) student numbers. It recommended that UCCQ should:

- "- adopt CML as a component of its administration and instruction in suitable subject areas where clearly defined benefits were anticipated, and
- allocate funds to support such an adoption"

(Clayton et al, 1989, p1).

Development Pathway

Tertiary institutions, in particular the Queensland University of Technology (Ellis, 1989) and the University College of Southern Queensland (Division of External and Continuing Education, 1986) have clearly demonstrated the success of the centralised CML model. The Working Party argued on the following premises that this approach would:

- provide a focus for and economise on CML development,
- ensure a continuity of staff efforts so that when staff leave and government funded projects terminate, CML project work commenced is not abandoned,

- ensure that CML support infrastructures are not duplicated, and
- enable all academic teaching areas, not just those that were the technologically "elite", to benefit from this form of technology-based teaching.

UCCQ has the advantage of being a relatively small institution and had already demonstrated a co-operative spirit to computer-based teaching technologies through the activities of a Computers and Learning Interest Group.

Thus the proposed development pathway for the implementation of CML was to:

- adopt a centralized model for a coordinated approach to the implementation of CML. To do this the University needed to develop an infrastructure by establishing a CML unit to act as a focus for, and a coordinator of, CML implementation and development. It was proposed that the unit would be staffed, in the first instance, by a coordinator who would be responsible for the establishment and implementation of a centralised CML system. The coordinator would also be in charge of programmers coding subjects into the CML system and would liaise with a CML development officer from each School. The development officers would support and advise academic staff whose subjects were being put on the CML system.
- proceed with the use of a commercial CML system. Given the experience of other tertiary institutions, the Working Party recommended that commercial CML authoring software be purchased rather than developed in house. Given access considerations for staff and students, on-campus at branch campuses and at a distance, it appeared appropriate that the CML system should be microcomputer based and preferably using IBM/MS-DOS compatible microcomputers with the facility to upload/download to the Students' Records system.
- commence pilot projects. Several Schools had identified appropriate projects and had indicated willingness to be involved in such projects.

Costings

The report was accompanied by a provisional budget for a three year pilot involving all six Schools. This budget is summarised in Table 1.

The setup software costs comprised \$45,000 for the purchase of commercial CML authoring software and \$30,000 for programmers' salaries (excluding on-costs) for creating the software links to the Students' Records System. CML staff salaries comprised the salary of a fulltime coordinator and six-half time programmers who would code the CML subjects for the six Schools. The salaries of academic staff involved in developing CML subjects were not included as this was perceived to be a School supported cost.

Table 1.

Budget for Establishment of a CML Unit

Setup Costs	
CML Authoring Software	\$45,000
Software links Students' Records System	\$30,000
Development Hardware	\$38,000
Microcomputer Laboratory	\$78,000
Total	\$191,000
Recurrent Yearly Costs	
CML Staff Salaries	\$113,000
Software Maintenance	\$13,500
Hardware Maintenance/Replacement	\$29,000
Total	\$155,500

Few routine computing systems operating in business stand up favourably to a detailed cost/benefit analysis (Bingham and Davies, 1972). The Working Party report did not attempt to provide a detailed cost/benefit analysis of the use of CML nor to cost CML as a separate teaching activity. Indeed UCCQ has never budgeted individual teaching activities in order to determine the cost effectiveness of a teaching technique. Cost/benefit scenarios were drawn from past experience of the Working Party members (Clayton and Smith, 1984; Zelmer, 1989) and based upon CML implementations at the University of Queensland (Stanford and Cook, 1987b) and at the University College of Southern Queensland (Crock and Timmins, 1988). The Working Party was cautious in paralleling the costs of teaching activities at UCCQ to the costs at other institutions with different funding arrangements.

Consideration of the Working Party's Report

Whilst, at senior management level, there was general support that CML could assist teaching effectiveness and efficiency, no decision was made initially to adopt the recommendations of the Working Party when they were presented. In retrospect, this was basically due to:

- the perceived "excessive" cost of establishing the CML infrastructure and the yearly support costs as "hard" costing data was lacking,
- some members of the senior management structure did not agree with the centralised model of a coordinated approach, preferring School-based projects, and
- the reluctance of the Working Party to provide a detailed costing of CML teaching versus other forms of teaching.

During the period November 1989 to July 1990, a number of meetings were held between senior management and the Working Party concerning clarification on aspects of the report and considering additional information on the use of CML.

Significant events in that period included:

- Whilst not adopting the Working Party's recommendations, senior management sought expressions of interest from members of the Working Party to be seconded as the

coordinator on a half-time basis. The Working Party argued strongly for the appointment of a full-time coordinator, so that person could devote their entire energies to the task and also operate independently from "loyalty to School" constraints. No member of the Working Party was interested in a full-time secondment.

- Some Schools felt they could not wait for senior management to accept and implement the Working Party's recommendations. For example, the School of Health Science had commenced a DEET funded CAL/CML project, and needed to make immediate decisions on software and hardware delivery systems.

- The School of Business commenced using paper-based multiple choice tests marked by an Optical Mark Reader purchased jointly by the Schools of Business, Science and Health Science.

- Initially, senior management decided that a pilot involving all six Schools was too costly and requested the budget for a pilot limited to two Schools. This was broadened to include three Schools, on the request of the School of Health Science as they were already undertaking a CAL/CML project. The budget was revised to include three Schools.

- As expected, the decision as to which Schools should be "in" the pilot was a controversial one. The Working Party recommended that, for a meaningful trial testing all facets of the development and delivery system, Schools involved should teach large classes on campus, at branch campuses and in distance mode, and have test banks that were text and graphics based and involve complex scientific and mathematical formulae.

- The Working Party provided senior management with an action plan for the six semesters of the pilot. This included setting time lines for establishing the CML support infrastructure and subject development. Detailed resource requirements and the pilot "system capacity" in terms of potential number of subjects that could be developed and implemented were determined.

- Because of the potential costs (which would need to be drawn from the top of the School's budgets), both for a reasonable pilot and for the long term, the Vice Chancellor's Committee requested that the Working Party summarize their report and associated documentation for submission to the Academic Board for their consideration. The Vice Chancellor's Committee wanted support from the whole academic community before proceeding with the Working Party's recommendations.

During this period the campus staff were kept informed of the progress made by the Working Party through several public meetings held at UCCQ.

Adoption of Recommendations

In August 1990 the Working Party submitted a proposal to the Academic Board which recommended that a CML pilot project be funded for an initial period of three years in order to demonstrate that using CML could improve the efficiency and effectiveness of teaching and to provide a basis for a coordinated approach to CML at UCCQ.

The Working Party did not feel at all confident that the Academic Board would support its recommendations, mainly because it required a significant funding commitment for a number of years without the guarantee that there would be a real cost/benefit savings. However, extensive lobbying in all Schools and Service Units prior to the Academic Board meeting did seem to indicate general support for the proposal.

The Working Party were concerned that taking such an involved proposal to such a large forum would result in it being referred to, and buried in, the University's committee structures with the possibility that a decision would be delayed indefinitely. However, after much debate on the cost of the pilot and who should/wished to be in the pilot the Academic Board supported, in principle, the Working Party's recommendations and indicated that this support should be conveyed to the Vice Chancellor's Committee.

In view of Academic Board's response to the proposal, the Vice Chancellor's Committee then sought advice from the University's Operations Grants Committee on how to proceed to fund the project. The implementation phase had finally been reached!

A Postmortem

It is of interest to reflect on the process outlined, and in doing so hopefully provide guidance for other institutions about to embark on a similar exercise.

Use of Existing Staff as Consultants

There are advantages and disadvantages of using the expertise of staff within an organisation to advise management on the wide scale introduction of technology-based teaching. From management's point of view, internal consultants are cheap, as these staff are already salaried, and they already know the organisation's operations and structure. Internal consultants may need to work to longer time lines as they are doing the consultancy on top of normal duties. As their time is not being costed, repeated requests for further information, and to restructure recommendations and proposals can be made. The Working Party was prepared to meet these demands as it was convinced of the merits of its recommendations.

Whilst the cost of an external consultant is an up-front cost that must be met by management, organisations sometimes place (whether rightly or wrongly), more credence on "outside" advice. Perhaps there is also more commitment by management to the more timely adoption of an external consultant's recommendations, as they have "paid" for this advice.

Information Provision and Dissemination

Early in the investigation process, it became apparent to the Working Party that few academics really knew what CML was. Several academics confused CML with CAL. In retrospect, a prototype CML system that could be demonstrated to both academic staff and management would have been extremely valuable.

Whilst information was gained and disseminated at the "public" meetings, and Working Party members had lobbied most of the academic board representatives from each School and Service Unit, some members of the Academic Board and senior staff still argued that they were not aware of the background and previous extensive consultation that had preceded the proposal to that Board. This could have perhaps been averted by the Working Party attending the Board of Studies Meetings for each School, prior to the proposal being put to Academic Board, and further explaining their recommendations. Although this would have been an extremely time consuming exercise, the Working Party consider, in hindsight it would have been time well spent.

Information dissemination was not assisted by senior management.

"The Working Party recommends that the information contained in this Report be widely disseminated, for example, to the Academic Staff Association, to the Student Union, and to the Institute's Management Advisory Committee" (Clayton et al, 1989, p 2).

Contrary to this recommendation, the initial report was not widely distributed. In this regard, the Working Party itself should have widely circulated a summary of the report to all academic staff.

Delays

The Working Party considered that an inordinate amount of time elapsed from when the report was initially presented to senior management to when a decision was made on implementation. This can be more clearly seen in the time-line in Figure 1.

Perhaps an equal amount of time will elapse before subjects using CML are actually developed and implemented. Are these time lines on decision making usual for institutions such as UCCQ or do they reflect senior management styles? It is likely that these delays

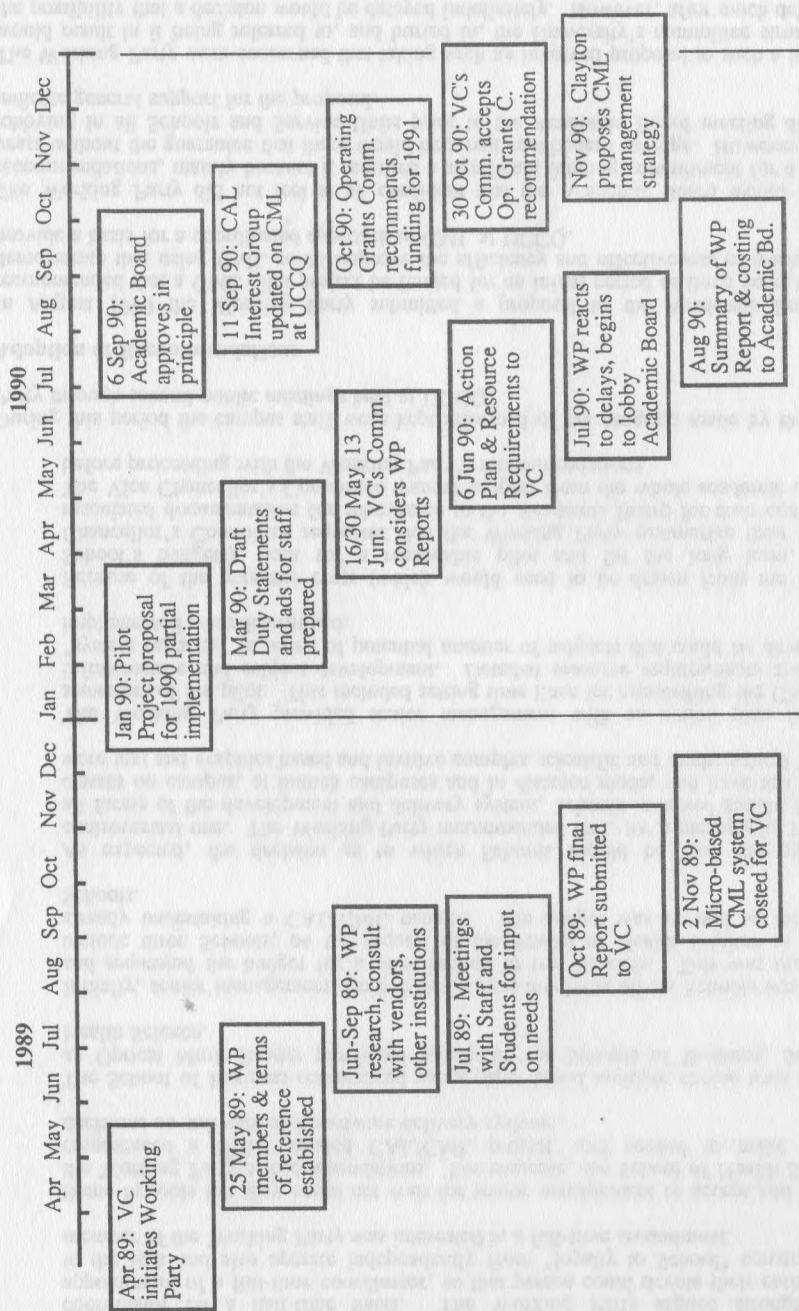


Figure 1: UCCQ CML Timeline

did cause problems as some new staff on the Academic Board claimed that they were unfamiliar with the background to the CML proposal.

CML Costs and Benefits

The Working Party found that virtually no detailed information existed comparing (in a tertiary environment such as UCCQ) the costs of using traditional teaching methods to the wide-scale use of CML based methods.

Whilst there was general agreement on the Vice Chancellor's Committee that CML could improve the quality of a student's educational experience, some members failed to be convinced that CML was cost effective. This was the issue that proved most difficult for the Working Party, as they did not feel at all confident that they could accurately quantify the cost savings. Although cost saving scenarios were presented, failure to quote a firm figure as a cost saving of CML over traditional teaching methods certainly was detrimental to the progress of Working Party recommendations being adopted. Cynically, one could argue that senior management is much happier with detailed but possibly inaccurate average cost estimates, rather than less detailed more accurate estimates. Even more cynically, the real costs of this lengthy feasibility phase for CML introduction no doubt exceed the budgeted costs for the pilot implementation!

Concluding Comments

At the time of writing, the Working Party has now completed the process of advising on the wide-scale introduction of CML at UCCQ. The next phase in this process is for a new, more widely representative, coordinating committee to be established to implement the Working Party's recommendations. Despite the considerable time commitment involved and the frustrations experienced by the Working Party members during the past 20 months, it is envisaged that most will be keen to be involved with the implementation phase!

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Abstract

The purpose of this study was to investigate the effectiveness of a computer managed learning system in a first-year introductory economics course. The study was conducted over a period of one year and involved a comparison of the performance of students who used the system with those who did not. The results of the study indicated that the system was effective in increasing student achievement and reducing the time spent on the course. The system was also found to be user-friendly and enjoyable to use. The study has implications for the design and implementation of computer managed learning systems in tertiary education.

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and
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THE EVOLUTION OF AN ADULT EDUCATION RESOURCE CENTRE
TOWARDS POLITICAL AND ECONOMIC

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