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ABSTRACT

This project involves a comprehensive generalizable and transferable evaluation of the Courseware Development Project (CDP) at Dalhousie University's School of Business Administration. This C$3 million, three-year project is divided into four levels over three time phases.

The results of the study of the impact of this unique project are expected to be both relevant and applicable to other universities in Canada and throughout the world. This on-going evaluation of the CDP centers around a systems model where: inputs are divided into drivers and materials; throughputs are the conversion processes on a matrix composed of six parties (faculty, students, staff, administrators, organizational structure and processes, and contributing/participating corporations) as the rows and the four levels of the CDP as the columns; and outputs are divided into manifest and latent variables. Demographic, attitudinal, behavioral, and organizational variables will be used in a time series analysis.

Using an action research model over the proposed three-year full study, the researchers will assess which elements of the project are effective at the end of each year of the evaluation. Based on this information the researchers will keep the effective elements in place for the next year and modify any ineffective elements based on the first year's results and competing theory. This cycle will be repeated after year two. Thus the proposed study will contribute to evaluation methodology as described in this paper by treating simultaneously both a case study and a quasi-experiment of the impact of computers on (business) education.

A preliminary description of the effects arising from Level 0, the integration of computers in the business school, and Level 1, courseware development, is given here. The general impact of the project upon faculty, staff, and students is described and preliminary findings are presented.

1. INTRODUCTION

The advent of the "computer age" has led many educators to predict that sweeping changes in post-secondary education will take place in the next decade. Specifically, material that was formerly delivered to students in the form of lectures, case analyses, experiential exercises, and text book reading will, at least in part, be transmitted as computerized "courseware." The benefits of this change are many. In general, students will have more flexibility to proceed at their individually optimal rates of learning and faculty will be able to devote more class time to areas that can only be learned in person-to-person interactions. These changes are expected to correspond to the communication changes that society will experience in the near future.

While speculation on specific changes runs high, a comprehensive investigation of how efficient and effective these changes will be has yet to be undertaken. The result of such an investigation will provide knowledge regarding the implementation of these changes and their expected benefits and costs.

A major obstacle to such an evaluation study is the identification of a field setting where computerization and extensive courseware are already being integrated into the curriculum. As opposed to carrying out a carefully controlled laboratory study, researchers monitoring a field experiment are better able to generalize their findings to other field settings. Such a field experiment is currently being conducted at Dalhousie University School of Business Administration as the Courseware Development Project. Funding for the full evaluation study is currently under consideration, but pilot evaluation work on student impacts has already been carried out.

2. THE COURSEWARE DEVELOPMENT PROJECT

The Dalhousie University School of Business Administration's Courseware Development Project (CDP) is a C$3 million vanguard effort that will serve as a model for other departments within Dalhousie University, other business schools in Canada, and other non-business school departments at other Canadian universities. Moreover, the CDP appears to be a unique effort to change post-secondary education delivery within North America and probably the world.

The CDP has four levels, set out in Figure 1. As displayed in the current three year Gantt chart in Figure 2, these levels are to a certain extent proceeding in parallel. The project is currently planned to continue over the next three year period, 1988 to 1991. Plans for the continuation period include the project evaluation detailed in the present proposal, but additional operational goals and their implementation remain to be set out by the project Steering Committee in the 1987-1988 academic year.

LEVEL 0 Integration of computers into the curriculum
- Providing an office-of-the-future environment for students

LEVEL 1 Development of business education courseware
- Freeing class and seminar time for developing "people" skills

LEVEL 2 Integration of instruction through realistic corporate databases
- Teaching a real-world corporate viewpoint on business problems

LEVEL 3 Developing state-of-the-art business decision support systems
- Maintaining an international research presence in business information science

Figure 1. Business Courseware Development Project: Project Structure

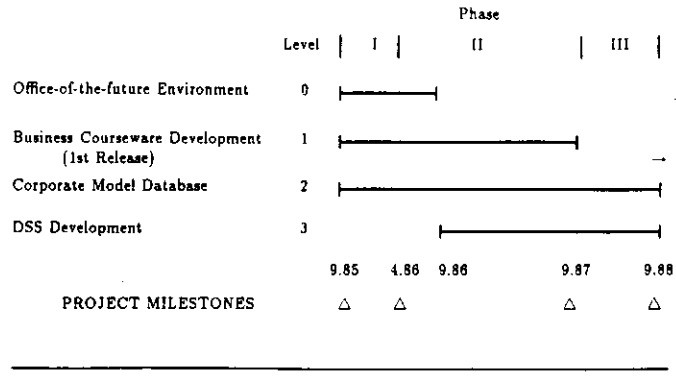

Figure 2. Business Courseware Development Project Diagram

Level 0 has the general objective of providing an office-of-the-future environment. Specifically,

> the computer hardware should be a 3-tiered system, beginning with faculty and student workstations hardwired through the dataswitch to an on-site minicomputer and communicating through it to central facilities and wide-area networks such as Datapac, BITNET/EARN/Net-North, etc. A microcomputer workstation should be provided to each of the 50-odd faculty and staff members -- regardless of previous computing experience -- and 70 microcomputer workstations should be available to students in laboratories. Further future extension of computing power should be through recommended individual student purchase of compatible personal computers financed through the University. Virtually all software installed should be previously developed, widely used and commercially available or freeware, leaving project efforts in this area to concentrate on coordination and use of software tools to revolutionize the delivery of the curriculum and enhance research. On the grounds of cost effectiveness, state-of-the-art technology should be used wherever possible. [Dempster 1986]

Level 0 was initiated in September of 1985 and completed (with the exception of student-owned machines, whose purchase is a continuing activity throughout the life of the project) in the summer of 1986. An incentive program involving Dalhousie University and several computer manufacturers sees personal computers made available to students at attractive prices with financing available at competitive rates.

Level 1 is concerned with the development of business courseware. The specific objectives are for faculty (through course release time) to develop courseware for all courses in the MBA and BComm curricula. Where cost effective and applicable, relevant software developed elsewhere will be bought. The courseware developed at Dalhousie will be offered to other North American business schools. In advanced MBA classes students are encouraged to develop modules of courseware as part of their course project assignments. After preliminary work, Level 1 was initiated at the beginning of 1986 and continues. Several tests have been undertaken (e.g., Sheridan 1986, 1987) and products are already under development (e.g., Maddox and Schellinck 1986).

Level 2 concentrates on building corporate information systems for class use, using a contemporary database management system and actual corporate data. This will allow students (and faculty) to practice analysis and decision skills in an integrated quasi "real world" environment. A state-of-the-art commercial database management system has been secured, together with a natural language front end; test projects have been undertaken with student participation; several major projects have been planned in detail and corporate data from small businesses and large corporations is currently being secured.

Level 3 deals with the development of "state-of-the-art" decision support systems. This level will further integrate the Business School with the corporate community. It should result in a significant impact on the management practices of firms in Atlantic Canada. Specifically, it will result in the strategic use of computer based information systems, increased and improved research in the administrative sciences, and an increased presence of the School of Business Administration in the corporate world. Interest by corporations and government agencies regarding joint projects at this level of the project has run ahead of expectations. Joint work on two major projects has already begun and details of several others are currently being negotiated.

3. THE OVERALL EVALUATION DESIGN

Figure 3 represents the inputs, throughputs, and outputs of the CDP graphically. It provides a useful scheme for evaluating the CDP. A comprehensive evaluation of the CDP must cover all its aspects. While a detailed listing of all variables to be measured is beyond the scope of this paper, examples of variables to be measured in each component of the model are presented below.

Pre-Project (CDP) Data

This component is essentially the pre-test in a pre/post-test design (Cook and Campbell 1979). Specifically, we measure the current satisfaction/dissatisfaction with communication, paced learning, course material realism, and understanding of business decision efficiency. These measurements will be repeated on all parties after each level is completed. This procedure will allow us to track the impact of each level on each party. Subsequent implementations of similar projects will then be able

to use appropriate levels for some parties and have a knowledgeable estimate of the results.

Evaluation by Levels

Each level has clear requirements to be completed. Level 0, for example, has already been essentially completed for existing faculty and currently registered students. Of course, students yet to be admitted to the School have not yet achieved Level 0 objectives, which for such people will recur year after year. All parties affected by the CDP will be surveyed regarding their retrospective attitudes and experiences with the Level 0 implementation. In addition, we will train five graduate assistants to conduct a behavioral observation analysis (a la Mintzberg 1972) on a volunteer sample of all people parties. In addition, we will pay 100 other volunteers to keep a detailed diary of their behaviors. Both the observation and the diaries will be analyzed separately after each level is completed, and their conclusions will be compared. The outcome of these analyses will tell us what end users actually do (rather than feel or think as in survey results) and whether or not the self-reported diary is as accurate as the observation.

Manifest and Latent Outputs

Manifest outputs (Figure 3) are those which are specifically targeted in the CDP design to be changed. They are the conscious goals of the CDP. The latent outputs were not specifically enumerated by the CDP but will probably change as predicted from a systems theory view of the project. Six parties will be manifestly and latently affected by the CDP. They are faculty, students (undergraduate and graduate), staff, administrators, university organizational structure and processes, and cooperating/participating corporations. A detailed review of manifest and latent outputs may be found in Appendix A.

Measures

Four categories of variables will be measured. These are demographic, attitudinal, behavioral and organizational. Each category of variables may be divided into the two types of interest -- latent and manifest. Examples of faculty latent variables are job satisfaction (attitudinal), requests for training seminars (organizational) and faculty commitment to the SBA (organizational). Examples of student latent variables are attitudes toward the SBA in general and fellow students in particular (attitudinal), spontaneous cooperative group work (behavioral), and a shift in career choices and majors towards MIS concentration (organizational). The bulk of the remaining measures detailed in Appendices B and C are manifest variables.

Action Research Component

It has often been observed that people do not know what can be achieved with a management information system until after they have used one. Therefore, all "people" party objectives will be organic. That is, as the levels of the project are implemented, new objectives -- as suggested by the parties involved -- are being added to the above list. A formal mechanism for recording and measuring these suggestions is being developed. This approach will allow for an action research paradigm regarding the CDP. The advantages of this method have repeatedly been extolled in the organizational development literature (see French and Bell 1984). Two specific advantages are applicable to the CDP. First, action research methods allow flexibility in measuring unforeseen yet important changes. Second, action research methods require a higher involvement of all parties to the change and thereby increase the commitment to the change. These advantages are seen as desirable to the implementation as well as to the evaluation of the CDP.

Experimental Design

Since the project has four levels, a time series analysis is most appropriate. While retrospective measures are notoriously inaccurate in detail, there is some recent evidence that they are more accurate in assessing global opinions (Murphy and Balzer 1986). Therefore, our retrospective measures will concentrate on general attitudes and behaviors.

Demographic variables will be collected through self reporting by individual faculty members in the first panel of the time series. It is unnecessary to collect these data in subsequent panels since they are either (1) unchanged or (2) predictably augmented (e.g., time spent at Dalhousie). Organizational measures during Level 0 can be assessed through a search of the School of Business Administration personnel files and should be accurate regardless of any subsequent passage of time.

Inputs

Examples

Level	Drivers	Material
0	Inefficient communication	Hardware and software
1	Standard pace of learning	Courseware
2	Lack of realism and integration of course material	Solicitation of corporate partnership and criticism
3	Lack of understanding of decision efficiency in business	Feedback loop to improve corporate efficiency

Throughputs

CDP Levels

Parties	0 Office-of-the-future	1 Courseware development	2 Database management systems	3 Decision support systems
Faculty	* Electronic mail	Development of courseware	Simulation of databases	Research in decision support systems and databases
Students	Spreadsheet analysis	Use of courseware	Use of databases	Use of decision support systems
Staff	Word processing	Expertise in use of software	Records management expertise	Refining of databases for more efficient use
Administrators	Electronic mail	Allocation of course release time for courseware development	Use of University (internal) databases	Strategic analyses for University and School of Business Administration
Organisation processes and structure	Electronic record keeping	Larger lower-level classes, smaller upper-level classes	Increased analysis of present strengths and weaknesses of SBA using internal databases	Reliance on staff to generate operating and tactical reports
Cooperating/ participating corporations	Tangible progress on CDP used to solicit more participation	Interest in executive development workshops using courseware	Acquisition of external databases	Increased use of DSS for business decisions

* Examples of conversion processes of the CDP for each party x level cell

Outputs

Examples

Level	Manifest	Latent
0	Quicker communication among faculty, staff and administrators	Increased positive attitude toward computerisation
1	More immediate feedback of learning progress by students	Change in type of student enrolled in SBA
2	More efficient retrieval of relevant information for administrators	Less need for increasing administrative staff
3	More efficient business decisions	Enhanced status of SBA in eyes of businesses

Figure 3. CDP Process Model

Values of attitudinal, behavioral and organizational measures will be recorded as each level is completed. In a simple cross-sectional experimental design we could conceive of the attitudinal measures as independent variables, the demographic measures as intervening variables, and the behavioral and organizational measures as dependent variables.

Hamilton and Chervany (1981) provide a framework for analyzing attitudinal, behavioral and organizational variables in an implementation of MIS. However, they point out -- as do other authors on implementation theory (e.g., Dickson et al. 1984; Lucas 1975; Robey and Markus 1984) -- that there has not yet been clear cut research on the directional flow of cause and effect. Our time series design across four levels will be useful in illuminating this issue.

4. STUDENT IMPACT EVALUATION: PILOT STUDIES

The impact of commercial computer-based training (CBT) within a traditional lock-step (lecture based) course has been evaluated (Sheridan 1986). The process of converting a conventional lecture based course to computer-managed instruction (CML) and the students' performance and attitudes to this change have been examined (Sheridan 1987). The use of conferencing software within a conventional

accounting course has been evaluated. The use of an intelligent computer-based problem solver has been tested in the context of case studies for an organizational behavior course. In this section each of these studies will be discussed in brief.

Commercial CBT in the Classroom

A database course developed for sale to industry was beta tested in an entry level business computing course. The six hour course was composed of eight modules organized under three headings: database introduction, database design, and database environment. It was decided that three modules could be used immediately within this traditional course. These disks covered the topics: database definition, types of databases, and database management systems. The students had, at this point, no experience with personal computers; however, the startup disk adequately covered an introduction to microcomputers.

Approximately 90 students participated in the study. They were pre- and post-tested, and asked to rate their experience and the courseware.

VAX Notes as a Communication/Evaluation Medium

The use of conferencing software as a means for debating issues, requiring student participation, and, as a result, a means for student evaluation was tested in a traditional advanced accounting course. More than fifty students participated in this unique experience. Data on their overall activities on the system and their attitude toward this novel approach were collected.

Computer-Aided Case Study Analysis

Although, building on previous experience with the central University mainframe, use of the new computer system (see Figure 4) was taken up with alacrity in quantitative courses, the usefulness of the technology within qualitative courses such as organizational behavior had to be demonstrated. A computer program called IDEA was implemented which allowed the instructor to present a narrative describing a case situation in a business environment and then, in a systematic, problem-solving framework, the student is assisted in identifying the salient features of the case by identifying variables and analyzing their relationships. A realistic action plan is derived to eliminate the problem presented in the case study.

> The programme was created to be an intelligence amplifier. Students express their thoughts to the programme by typing English sentences, IDEA then challenges them to explain in more detail, expand upon their thoughts, and to explore new perspectives. [Peacock 1986]

Three sections of an undergraduate BComm organizational behavior course were involved in the experiments: an untreated control group, a group making full use of IDEA, and a group allowed limited access to IDEA.

Converting a Conventional Course to CML

In this study, the introduction to business computing course was converted to a computer-managed learning environment. The CML software was purchased from Computer-Based Training Systems (CBTS), Calgary, Alberta, and had been successfully run at more than 100 sites. The code, first developed at the Southern Alberta Institute of Technology, is more than ten years old and has undergone continuous improvement. Research on an expert system as an authoring aid was announced by CBTS last year. At the School, the summer of 1986 was spent implementing the CBTS CML code, entering approximately 2,000 items in the test bank and writing introductions to each of the twenty modules created for the course. These introductory modules were written in PRODUCER, a Digital Equipment Corporation CBT language. It is believed that this was both the first use of CML in a business school and the first link of CML with PRODUCER. In the fall and winter semesters of 1986-1987 students progressed through the CML environment, used the electronic mail features, received twenty quizzes and four global tests online, and submitted to three conventional, supervised exams. In addition, assignments were required which developed their proficiency in WordPerfect, Lotus, database systems and general programming. In total, data on more than 200 students were collected.

5. PRELIMINARY FINDINGS

The Courseware Development Project, as described earlier, extends over many years and involves all of the disciplines of the School of Business. In its first year of operation the studies examined Level 0-1 stages. While the findings cannot be genera-

Table 1. Comparison of Means between Pre- and Post-Test Scores

T-TEST Module 1 N = 91

Test	Mean	SD	SE
Test1	1.78	0.99	0.10
Test2	3.34	0.79	0.08

Difference = -1.56 SD = 1.1 SE = 0.02

T-Value = -13.56 DF = 90 P = 0.00

T-TEST Module 2 N = 87

Test	Mean	SD	SE
Test1	6.14	2.41	0.26
Test2	11.44	0.87	0.93

Difference = -5.3 SD = 2.59 SE = 0.28

T-Value = -19.09 DF = 86 P = 0.00

T-TEST Module 4 N = 88

Test	Mean	SD	SE
Test1	2.70	1.86	0.2
Test2	6.08	1.78	0.2

Difference = -3.38 SD = 2.29 SE = 0.24

T-Value = -13.88 DF = 87 P = 0.00

Table 2. A Summary of Student Attutides Toward CBD

SA = Strongly Agree
A = Agree
D = Disagree
SD = Strongly Disagree
NA = Not applicable

N = 85
Responses (below) are in percentage terms

SA	A	D	SD	NA	QUESTION
20	68	7	5	0	I understand the objectives of this course.
22	55	18	2	2	Information given in this course will probably be useful in future jobs.
5	12	47	30	6	It would have been easier to learn this material by classroom instruction rather than by computer-based training.
32	53	11	4	1	I generally liked taking this course via computer-based training.
21	68	8	2	1	I would recommend this course to other students or university personnel.

I would rate the difficulty of this course as being.

Very Easy				Very Hard
1	2	3	4	5
17	35	39	8	1

lized to all levels of the project in all subjects, they are indicative of progress and of the potential of the project in general.

Commercial CBT in the Classroom

The ninety students involved in the use of a commercial CBT product were found to have gained substantially in knowledge of the subject matter (see Table 1). CBT was therefore found to be more than a fad or play toy. The time taken to achieve this competency was in line with conventional lecture time. In this instance, conventional lectures were not provided, but the time students spent on CBT was measured. Students strongly supported the use of this CBT courseware by responding in a highly favorable manner to questions based on the relevance of their experience toward course goals and employment goals. They also highly recommended the courseware to other students (see Table 2).

This study provided the first major example of the action research orientation of the CDP evaluation. Indeed, the excessive diskette management required by student use of such commercial CBT products prompted the design and implementation in the

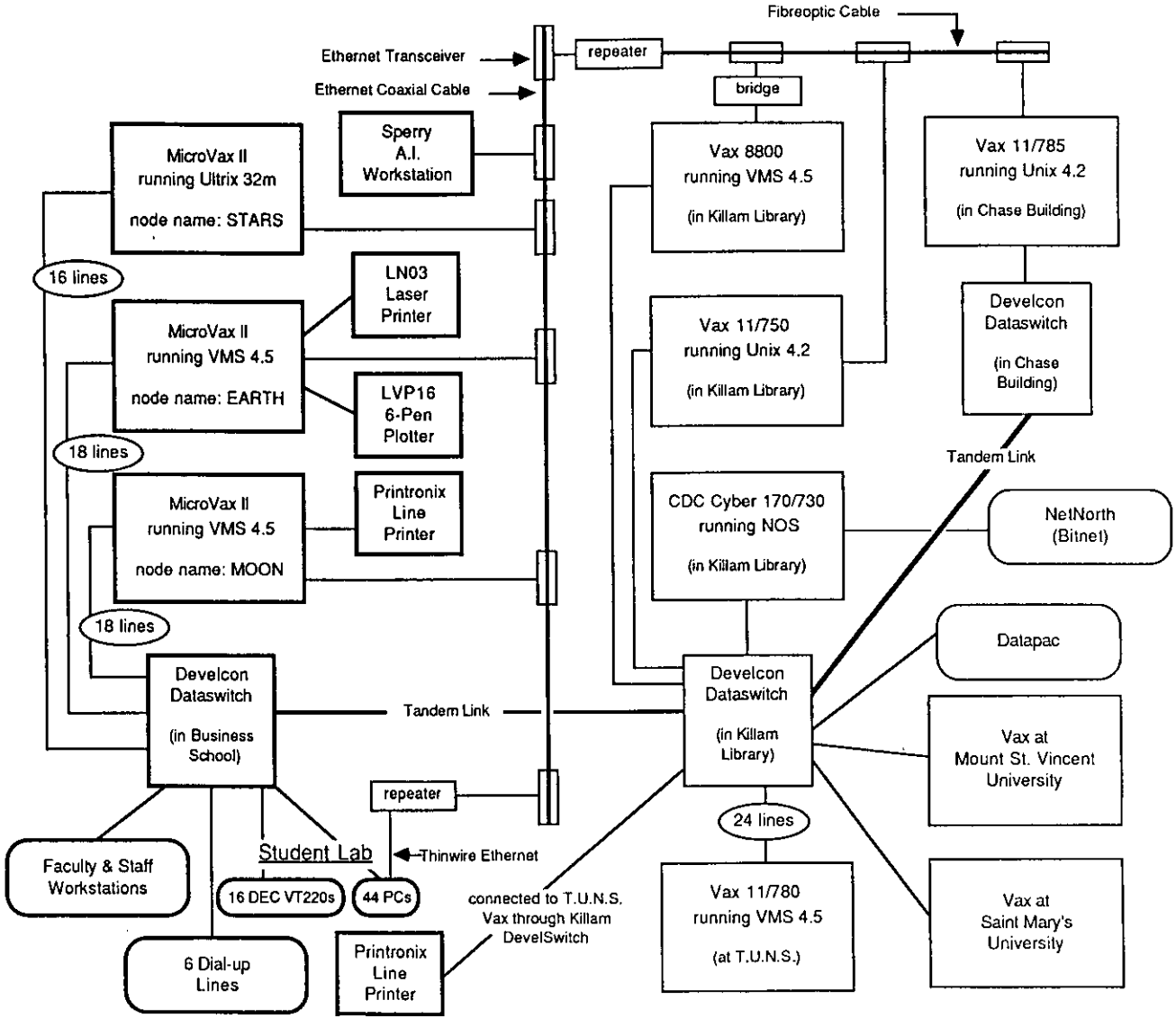

Figure 4. School of Business Administration/University Computer Systems

summer of 1987, in cooperation with Digital and with student council partial financial support, of a MicroVAX host-based thin-wire Ethernet local area network (LAN) for the PC laboratory (see Figure 4).

VAX Notes as a Communication/Evaluation Medium

The accounting students involved were surveyed for their opinion of the conferencing software and their marks were reviewed in comparison with previous years' performance. The instructor reported that perceptions were near the mean on each of the thirteen attitude dimensions used. They reacted very favourably to its ease of use and its purpose or utility within the course. Conferencing was not viewed as a replacement for traditional teaching methods, but was supported as a substitute for class discussions, the purpose for which it was used. Students claimed they spent three hours per week on conferencing; however, connect time recorded by the computer did not bear this out. Some students tended to list on the printer all of their classmates' contributions prior to making one of their own,

therefore total time on task could equal the three hours per week they estimated.

The instructor reported a high level of participation, excellent coverage of material, and higher than average class marks in comparison with previous years. The quality of student performance increased markedly over the term partly as a result of the quantity of feedback received from the instructor. It was reported that using VAX Notes by the instructor was initially more labor intensive than traditional classroom discussion, but eased up as methods evolved for processing the volume of text. Plans are currently being developed for use of this approach in introductory accounting courses in the coming academic year.

Computer-Aided Case Study Analysis

The statistical analysis of this carefully designed experiment is, at this date, incomplete. The student response to the use of IDEA as a stimulus to better case analysis was, however, universally and genuinely positive. It is believed that academics often underrate the instructional usefulness of computer dialogues because they understand the primitive nature of the natural language interface. In contrast, the end user often imputes a greater depth and breadth to the program than it deserves. As a result, the reflective questions or randomly generated questions (when a student response is not recognized) create useful thought processes and clarify issues. Thus IDEA was found to be a long way from the end goal of researchers in artificial intelligence but sufficiently useful to students that it will be used again and improved upon.

Converting a Conventional Course to CML

More than 200 students were registered in this CML environment. There was no control group, although much data existed over years to support or dispute any claim of progress. In overall terms there was asignificant reduction in the failure rate and a high level of course completion. Student attitudes to CML were generally consistent with their attitudes towards other courses taught in a traditional manner. The course is compulsory for all BComm students and is viewed as labor intensive. CML was not an emollient. Students reacted positively to the following terms: value, appropriate, good, understandable, pleasant, clear, useful, positive, and effective. None of the 20 attributes were scored negatively. In overall ratings, CML was judged between good and excellent -- it was very helpful in organizing work, more CML activities were desired, and the features of the technology most appreciated were self-pacing and the ability to review the material at any time. Criticisms, of which there were few, dwelt upon the amount of course material and frustration with "tricky" questions. Faculty are currently considering the conversion of introductory accounting courses to a CML environment.

6. DISCUSSION AND CONCLUSIONS

At this early juncture, we feel confident that our overall evaluation plan is conceptually correct and that the practical implications of the Courseware Development Project are as predicted.

The use of commercial CBT within traditional courses proved to be not only a pleasant respite for students but a practical and effective teaching method. Schools of business can offer a unique service to producers of complementary industrial courseware since we can quickly evaluate it and provide immediate and useful feedback on the subject and instructional design. Given the recognized ratio of 100 to 200 authoring hours for each contact hour used by the student, any useful courseware which is obtained through cooperation with industry represents a significant saving of faculty time. With modern host-workstation LAN technology running at ten Mbits/sec, central storage of CBT products and downloading to PC workstations on student demand is feasible. Practical experience with this concept will be reported in future work.

With respect to VAX Notes and conferencing software in general, the results in an advanced accounting course have led to its use in introductory accounting as well. Although it was never designed to be an educational tool, the fact that a conference can be created on selected topics within a course has proved to be easy to implement and trouble-free in operation. This approach to using newer technologies has a low risk of failure and may even be an effective way to introduce students to an electronic office environment.

IDEA as an aid to the analysis of case studies is a primitive but effective tool. It took the developers and instructors a significant amount of courage to try the concept. In this instance, one of the

instructors involved was in his last year prior to retirement! Student acceptance was genuine and the results support efforts at improving the software and using it again. As the artificial intelligence community makes more of its research available, programs such as IDEA will be greatly enhanced.

Computer Managed Learning is an effective productivity tool for instructors. This implementation was trouble-free from its inception and provided an excellent administrative medium for large courses. All student quiz marks, supervised exam marks, and assignment marks are online for report generation at a moment's notice. Individual students may review their progress and send electronic mail to their professor. The professor may send general class notices or messages to specific students. The status of the entire class can be reviewed before class or posted on a bulletin board. A MicroVAX can easily handle several hundred students logging-on twice a week for tests *or* tutorials. Response time was excellent and disk space utilization realistic. If a textbook is used which includes a disk-based item bank, CML can be brought on line within two weeks. CML is highly recommended for courses with large enrollments.

From computer-managed learning the project is moving forward toward the introduction of computer-asssisted learning (CAL) -- a form of technology which provides most of the information and data for the student to master. Currently an introductory statistics course is being developed in cooperation with the Division of Educational Research Services, University of Alberta. Based upon a graduate level 80-hour course, this courseware will import relevant portions of the code and add to it a structure and examples tailored to a business course. This venture is unique in that it combines the pioneering efforts of Dr. Steven Hunka and the research and development of his team's Educational Learning Facility (ELF) with the practical requirements of our School of Business to achieve a CAL course in the minimum amount of time. As indicated earlier, with authoring effort ranging from 100 to 200 hours for each student hour at a terminal, any existing and validated courseware which can be modified will result in a very significant saving in faculty effort. ELF is not only an authoring system but it is also a translator of IBM's Coursewriter II code and Control Data Corporation's Tutor (PLATO) code. Courseware written in either of these languages runs transparently through ELF on a DEC system running VMS. In a different context, ELF can be viewed as a process control language that is composed of the macro codes of all CML and CAL languages. The design objective of ELF was to allow educational institutions to cast a wide net for useful courseware in a variety of languages and then run it through this single software application. The Dalhousie School of Business Administration is the first beta test site for ELF.

In addition to ELF, the School has very recently reached agreement to beta test an internationally recognized CAL language called CANIX. For the first time CANIX is available on DEC VAX/VMS machines. In this instance, the Ontario Institute for Studies in Education's mathematics package will also be mounted by the School's computer center to thoroughly test CANIX in its new environment. The CANIX compiler and courseware have a value in excess of C$100,000. As a follow-on activity, we are negotiating a joint venture which would see the School's courseware development team involved with CANIX on a multi-million dollar training project for the Canadian military. Faculty at Dalhousie are also likely to participate in the specification and design of a CANIX calculus course through the interprovincial (intercollegiate) computer-user network, CANnet.

Thus, the experience we have obtained in designing, modifying, mounting, managing and validating courseware has led to an abundance of opportunities for future growth in technology within the School and the University. Dalhousie's School of Business Administration is the leading institution in Eastern Canada for work of this type.

In conclusion, the pilot studies have all been successful and are now leading to more CBT activities. It should be pointed out that the so-called "halo-effect" has no role to play in these findings; we believe the vast majority of our students are sufficiently computer literate that each of these innovations was judged on its merit. Students were certainly critical when the circumstances called for it. Based on our success, recent work on a small business simulator, tutorials on export marketing, and online personality testing are but a few of the innovations waiting for evaluation. Faculty, students and university administration accept the Courseware Development Project objectives and are demanding faster progress.

Satisfying this growing demand, given limited resources, will be a challenge.

CDP Funding

The Courseware Development Project wishes to acknowledge its corporate sponsors. These include the Bank of Nova Scotia, the Royal Bank of Canada, Digital Equipment Corporation, UniSys Incorporated, Maritime Tel & Tel, Nova Scotia Power Corporation, CAE Limited, Synerlogic Limited and the Dalhousie Capital Fund. Negotiations are currently in progress with several others, including Pratt and Whitney Canada, Ontario Hydro, the Department of National Defence and the Halifax Board of Trade.

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APPENDIX A. MANIFEST AND LATENT OUTPUTS FOR ALL PARTIES

Faculty

Faculty will have to change their day-to-day activities. Some of the manifest outputs of these changes are:

Level 0 use of an electronic-mail system, improved typing skills, word processing skills, and record keeping
Level 1 integration of the computer into courses, courseware development, graphics displays, multi-media presentations, computer-based testing and monitoring of students' learning, and evaluation of existing courseware
Level 2 database usage, use of a natural language, evaluation of suggested databases and software, and teaching students to use databases
Level 3 research activities, development of decision support systems within areas of expertise, interacting with corporate decision makers, and investigation into strategic information systems usage

Some latent outputs are:

Level 0 committee work use of electronic conferencing and subsequent decreased time in meetings
Level 1 use of secretaries as paraprofessionals
Level 2 more time spent preparing "people" skills presentations for class time
Level 3 more information sharing and team building with administrators

Students

Both undergraduate and graduate students will be affected by all levels of the CDP. Some of the manifest outputs of these changes are:

Level 0 use of electronic mail for communication and assignment delivery, increased typing skills, and word processed term papers
Level 1 shift in the behavior leading to learning, increase in outside class hours spent at a computer (courseware), more in-class hours spent in "people" skills, more immediate feedback of learning progress, and more "hands-on" experience through courseware development projects
Level 2 more "real world" simulation and corporate-wide integration of viewpoint and skills through database supported exercises
Level 3 more contact and empathy with corporate executives, and greater input on corporate processes, through development of DSS

Some latent outputs are:

Level 0 partial substitution of office hour visits by electronic mail
Level 1 heightened awareness of progress in courses relative to other students
Level 2 quicker (electronic) notification of enrollment in courses
Level 3 more timely and frequent notification (electronic) of progress in degree program

Staff

The School of Business secretaries, while often overlooked as parties to the CDP, will experience sweeping changes in their jobs. Some of these manifest changes are:

Level 0 increased use of word processing skills (the secretaries will become the in-house experts in word processing) and less time spent in simple typing (due to increase in faculty and administrative typing)
Level 1 more time spent as text/graphic display consultants and more time spent criticizing and reworking "general public" releases (e.g., letters)
Level 2 more time in database reporting, retrieval, and manipulation, more time evaluating software, and more time learning administrative sciences reference manual citation formats
Level 3 more time suggesting efficiency improvements in office situations and using DSS procedures as directed by administrators and faculty

Some latent outputs are:

Level 0 greater job satisfaction
Level 1 increased status in the eyes of faculty and administrators
Level 2 increased autonomy
Level 3 formal performance appraisals

Administrators

As with the introduction of any management information system, the role of administrators will change. Some of the manifest changes include:

Level 0 increased typing skills and quicker and more frequent feedback with other administrators and faculty
Level 1 greater availability of quantitative indices of effectiveness and more time to spend on face-to-face interaction
Level 2 less time spent gathering information and more delegation of operating and tactical issues
Level 3 more time spent on strategic decision making and quicker and more frequent "census taking" on strategic issues

Some latent outputs are:

Level 0 less time spent in face-to-face meetings with faculty
Level 1 more degrees of freedom in making student/faculty ratios meet budget projections
Level 2 higher status in the eyes of other university administrators
Level 3 higher status in the eyes of corporate executives

Organizational Structure and Processes

Changing people's roles in an organization causes ripple effects. With the change in roles there will have to be a change in structure and processes. Some manifest outputs are:

Level 0 more staff hired to maintain hardware and software
Level 1 hiring permanent programmer/analysts for the School of Business Administration
Level 2 quicker preparation of better reports to university administration
Level 3 greater need for goal setting and performance monitoring to measure goal achievement

Some latent outputs are:

Level 0 transition period of higher positive excitement yet higher anxiety from the rapid changes causing increased noise in communications
Level 1 settling down of noisy communications as people adapt to new conditions

Level 2 formation of policy making task forces
Level 3 less power differentials between all people and parties due to fewer information differentials

Cooperating/Participating Corporations

The CDP was designed in part to bring the School of Business and Atlantic Canada businesses closer together. Some of the manifest outputs are:

Level 0 increased monetary donations to the School of Business
Level 1 keeping abreast of developments in the SBA regarding computer-based training delivery systems
Level 2 increased thought on how corporate databases can be made available without violating confidentialities
Level 3 greater communication with SBA members (administrators, faculty and students)

Some latent outputs are:

Level 0 more inquiries to the School of Business about the "best" hardware and software for the corporation to purchase
Level 1 more guest lectures by executives
Level 2 greater hiring of SBA students upon graduation and delegating major information systems responsibilities to them
Level 3 greater use of SBA faculty as consultants

APPENDIX B. FACULTY EVALUATION EXAMPLE MEASURES

Four types of measures will be collected. These are demographic, attitudinal, behavioral and organizational.

Demographic: Examples of the demographic measures are sex, age, academic rank, computer experience, time as a professor at Dalhousie University, time and number of other university posts, and area of specialization within the School of Business Administration.

Attitudinal: Examples of attitudinal measures are attitude toward computers, attitude toward computers as educational tools, attitude toward the Courseware Development Project, opinion of the status of the Dalhousie School of Business Administration, job satisfaction (combination of satisfaction with administration, peers and students -- items taken from the Job Description Index and the Research Centre Survey guided team building questionnaire), and opinions of the quality of the student body, both undergraduate and graduate.

Behavioral: Examples of behavioral measures are typing skills, use of electronic mail, use of word processing packages, use of record-keeping programs (e.g., Lotus 1-2-3), amount of time and frequency of assessing host machines, usage of laser printers and plotters, usage of data projectors, usage of computers in syllabi for courses, requests for tutorial disks and training seminars, amount of local printer paper used, and amount of line printer use. The preceding measures will be collected unobtrusively as well as directly wherever possible (Webb et al. 1966). In addition, there will be graduate students hired to directly observe behavior (see Komaki, Zlotnick and Jansen, 1986) and diary records (self-reported behavioral observations) of actual computer use for job related tasks.

Organizational: Examples of organizational measures are decisions rendered by the Rank, Appointment, Tenure and Salary Committee, course assignments by the administration, course release time, student opinions of course effectiveness, actual use of computers in the classroom, student use of computers, development of and use of courseware, faculty commitment to the School of Business (as measured by turnover rate and turning down offers from other universities), clarity of the goals of the CDP and SBA, and the University's commitment to the SBA (budget envelope, opinions of administrators, and requests for help in setting up similar projects in other departments).

APPENDIX C. STUDENT EVALUATION EXAMPLE MEASURES

Four types of measures will be collected. These are demographic, attitudinal, behavioral and organizational.

Demographic: Examples of demographic measures are sex, age, marital status, English comprehension, years of study at the School of Business Administration, years of study at a post-secondary institution, computer experience, work experience, major and GPA, score on GMAT or GRE (if available), distance of esidence from the SBA, full or part time status.

Attitudinal: Examples of attitudinal measures are attitude toward computers, and computers in education, attitude toward non-traditional learning methods, attitude toward the CDP objectives, the SBA in general and fellow students in particular.

Behavioral: Examples of behavioral measures include typing skills, scores on course objectives and sub-objectives which use CDP technology, frequency of use of electronic mail and CDP technology when not directly a part of a course objective (voluntary use of word processing, spreadsheet, statistical and database software). Clear, unambiguous statements in support of the CDP objectives. Cadres of students working cooperatively on CDP objectives will provide additional overt evidence of successful implementation.

Organizational: Examples of organizational measures are student comments arising from the annual course evaluation process, development of courseware by students as projects in undergraduate and MBA level MIS courses, increased enrolment in the SBA directly attributable to the CDP project, demand for enrolment by students within the university but outside the SBA, demand for CDP project documents by former students and students of other institutions, a shift in career choices and majors toward an MIS concentration.