

INSTRUCTIONAL COMPUTING
DEVELOPMENT PROJECTS
AT THE
UNIVERSITY OF THE WESTERN CAPE
1982 - 1987

Prof. A.J.L. Sinclair

*Director of the UWC Teaching Centre
University of the Western Cape*

Prof. R.J. Kansky

*Instructional Computing Consultant
University of Wyoming*

Too Expensive at Half the Price

The projects and, consequently, the budgets reflect the effort to provide the time and manpower needed to develop a **quality** product of national consequence. The budgets are not inflated. However, in proposing these projects, there has been active resistance to the impulse to allow the budget to control the goal of the projects. While something could indeed be produced with less testing by fewer qualified personnel in less time, it was decided that half a loaf, in this case, would not be better than none. Unless the development of this significant effort can be done properly, it should not be done at all. A poor product at half the cost cannot be considered as anything but a total waste of money and time at a juncture when both are in short supply.

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Accommodating Curricular Change

Of course, content and emphasis within the curricula of mathematics and the sciences will continue to change. In the past, these changes have been implemented by rewriting the matriculation syllabuses --a procedure which inevitably created a need for new textbooks. If there were errors or weak sections in the revised textbooks, corrections or modifications (if done at all) had to await the publication of a new edition. If new topics were introduced in the revision, teachers could find themselves unable to develop the classroom lessons needed to expand upon the text. In this situation, instruction becomes "textbound".

The computer-based curricula which are to be developed by this project will also need correction and modification to meet the needs of a changing South Africa. In the case of computerized lessons, however, corrections and modifications are not subject to the time delays and reprinting costs of textbooks. By monitoring the curriculum's file of comments from students and teachers, an author can regularly improve his work. Not only can such comments lead to the speedy correction of errors, but they also provide the feedback which is necessary for **user validation of the material**. In this way, the author learns of misconceptions developed by a lesson or of the need for additional steps within a development. Poor lessons can be retired and new lessons added as these needs are recognized. The result is a living curriculum which responds to both the needs of students and the needs of society — and it does so along a continuous time line.

Building upon Experience

It is important to note that the curriculum development work at the University of the Western Cape will capitalize upon the considerable experience of Control Data. Although the specific content and bilingual design of the materials to be developed by the three mathematics/science projects are unique to South Africa, the principles of design and standards of evaluation already exist. These have been refined and documented by Control Data in the course of its generation of thousands of computerized lessons. It is the combination of such experience with the clear sense of purpose and subject-matter focus of the UWC projects which make the proposed task feasible.

What is Plato®?

PLATO® (hereinafter called PLATO) is the registered trademark of an instructional computing system which was developed by the University of Illinois. The system is now marketed and serviced in South Africa by Control Data (Pty) Limited.

The hardware and software of the PLATO system currently give the user access to more than 6 000 hours of tested lessons spread over several disciplines. It is the largest computer-based lesson library in the world. New lessons are added each year; existing lessons undergo continuous re-evaluation and modification.

PLATO was designed specifically for use as an instructional delivery system. It utilizes a unique PLATO Learning Management (PLM) package which aids both students and instructors by managing testing activities, by assisting in learning-aid selection, by maintaining detailed but easily summarized records of student progress, and by providing for the regular student-instructor communication which is an essential part of individualized instruction. The following are some of the instructional advantages which are features of PLATO in general and PLM in particular:

- * adaptation of instruction to fit the entry-level skills of the individual student
- * adaptation of instruction to accommodate the learning speed of the individual student
- * adaptation of instruction to suit the learning style of the individual student

The Budgets: A Question of Quality

The total budget for the three projects is big, but so is the task. The purpose of the combined effort is to improve instruction in mathematics and the sciences in such a way that South African education may meet the technical requirements of its present and future manpower needs.

A National Focus

The five-year plan of the University of the Western Cape is of national intent. It seeks to develop materials and procedures which will bridge the mathematical/scientific gap between secondary education and tertiary studies, thus fitting the profile of university graduates to the profile of employment opportunities. Because of the critical level at which the material is directed, these same lessons are suitable for secondary school students (to provide improved or advanced instruction), secondary teachers (to improve their instruction and to upgrade or refresh their subject knowledge), and undereducated adults who have terminated formal education but now seek the academic skills necessary for advancement in their jobs.

While the University of the Western Cape and participating institutions of the Cape area will be at the centre of this curriculum development activity, there is a need for the products of these projects throughout South Africa. The projects seek to serve that broader audience. Materials and procedures developed by the projects, through the delivery system of PLATO, will be available to persons throughout the country.

- * presentation of instruction at times adjusted to meet the schedule of the learner
- * elimination of group pressure on the learner
- * control of student progress based upon mastery criteria or normed testing
- * efficient utilization of limited resources (laboratory stations, tutors, equipment, etc.)
- * provision of learning feedback as a basis for continuous student/instructor interaction

should be going. The proposals associated with this five-year plan define a clear goal; consultants are but a means of attaining it. Second, it is UWC's intention that, insofar as possible, each invited consultant should undergo "academic cloning". To this end, each of these consultants will be paired with a South African project member. That member will have to be prepared to assume the international consultant's role by the time that the consultant leaves the project. He must, in fact, be prepared to train others.

But the value of computer-based education would be greatly diminished if staff development were restricted to the tertiary level. Hence the proposed projects include plans for training hundreds of teachers in the use of computers in education. The projects also will engage the skills of these same teachers in evaluating and refining the material (computer lessons) and procedures developed by the projects. Finally, the plan seeks to make educational computing facilities available to students and adults outside of the University.

Now the hidden agenda is no longer hidden. If the projects of the University of the Western Cape are successful, each international consultant will work himself out of a job in South Africa.

What is the Teaching Centre?

The Teaching Centre came into operation at the beginning of 1980. It was established to fulfil the functions described below:

1. Academic Planning

The Centre forms the hub of all aspects to academic planning and is specifically charged with the following principal tasks:

- * the identification, in conjunction with the University's Physical Planning Unit, of physical facilities needed to meet present and future academic demands
- * the planning of the formal educational structure, involving general and professional education at undergraduate as well as post-graduate level
- * the planning of the non-formal educational structure which supports various outreach programmes
- * the initiation, stimulation, and co-ordination of research, including individual and group research projects

2. Teaching

The other major concern of the Teaching Centre is the improvement of the teaching process, both on- and off-campus. Its main tasks here are:

- * to identify and analyse problems which hamper academic progress

A Hidden Agenda

An unstated objective has guided the writing of the aforementioned proposals on computer-based education:

South Africa must develop a cadre of its own citizens which can maintain and develop computer-based education facilities.

While South Africa will continue to interact with the world's community of scholars in this area, the intention is that its future interaction will be as a full partner. Therefore, while it will continue to value the ideas and skills of others as protection against academic isolation, it will itself be valued for its expertise and bold vision in the instructional use of computers.

South Africa moves out from a position of strength in seeking its academic independence. The PLATO facility at the University of the Western Cape is amongst the finest in the world. The teaching and administrative staff members of the University have committed themselves to an investigation of major alternatives in the provision of tertiary education. It also seeks to develop strong ties with secondary schools in order to bridge the educational gap which now exists. The combination of excellent computing facilities and a positive atmosphere of educational innovation provides an ideal environment for progress.

For the next few years, the development of instructional computing at the University of the Western Cape will call for input by international consultants. However, there are two notable conditions which guide the request for such outside help. First, the experts will be selected to help UWC get where it wishes to go **rather than to tell it where it**

- * to reassess the teaching situation continuously
- * to draft and implement teaching strategies and programmes in co-operation with both university and national education departments
- * to offer guidance on the best use of teaching aids (including audio-visual aids, the library, and learning media such as PLATO)
- * to provide both theoretical and practical information on the latest teaching research

The Teaching Centre, being at the focus of the academic structure of the University, is in the ideal position to initiate outreach programmes as the most vital part of its commitment to the education of the wider community.

do not match those required by employers. In this case, moreover, the persons affected have usually terminated their formal education. An alternative to traditional classroom instruction is needed.

While the objectives associated with the use of PLATO in the teaching of Afrikaans are not distinct from those of the three projects outlined, they are of such complexity as to demand development in a future companion proposal. It is sufficient here to note that the population served by the Afrikaans PLATO project will include the groups (teachers, secondary school students, university students, adult students) addressed by the mathematics/sciences project. Hence, the new project may utilize the educational structures and physical centres already established. In addition, the Afrikaans project will address the needs of English-speaking professional persons with business or academic involvements in South Africa.

Plato at the University of the Western Cape: 1982

The University of the Western Cape has made a major commitment to instructional computing. Its 64-terminal PLATO system makes it the third largest computer-based educational centre in the world. The present terminals serve an on-campus population to answer the educational needs of a broader community. It was specially equipped to provide a curriculum content outreach plan for high school students, teacher education programmes (particularly in mathematics, the sciences, and English and Afrikaans usage), continuing education programmes for adults (including a basic skills package), and computer-based educational research relevant to South Africa¹.

The mainframe computer purchased by UWC to support its instructional computing programme is capable of doubling its present load of terminals with no observable reduction in response time. It can be extended to handle many more.

In anticipation of the development of off-campus centres to reach the broader population for which it originally purchased PLATO, the UWC is planning a new telephone switchboard which will dedicate up to 25 channels (50 telephone lines) to provide off-campus instructional centres access to PLATO. Since each such channel can accommodate a maximum of eight terminals, the present limit to outreach development is 200 terminals.

1. Sinclair, A.J.L. *Computer-based Education at the University of the Western Cape*, Bellville: UWC Teaching Centre, 1980.

The "Missing" Project

The instructional computing development projects described in the previous pages constitute a major step towards the University's overall goal of improving instruction at all levels. The plan falls short of meeting this overall goal by limiting the range of subject areas to be attacked. This loss of curricular breadth was accepted as the price of defining an interrelated group of activities which focus upon those academic areas comprising the first priority for educational improvement efforts.

The lessons learned and the procedures developed in the course of executing the projects proposed so far will be of unrestricted value insofar as they can be applied to other subject areas and other populations. In particular, they should guide development in an area of secondary priority, viz. a computer-based curriculum in the Afrikaans language (including its application in fields such as business, education, mathematics, and the sciences).

Although 67 per cent of the students of the University of the Western Cape claim Afrikaans as their primary language, University instructors are well aware of the low level of facility with which language skills in Afrikaans are applied to tertiary study. As a specific example, instructors in mathematics and the sciences report a near void in students' abilities to analyse, synthesize, and report results in these fields. In general, evidence of a student's understanding of concepts is obscured by his inability to communicate that understanding.

As far as Afrikaans in the business world is concerned, employers confirm that limited language skills are a significant factor in barring professional advancement. In short, the academic skills of jobseekers

Three Projects: One Goal

The development of instructional computing at the University of the Western Cape has a single goal:

To use instructional technology to improve education to all levels.

For the five-year period 1982-87, progress towards this goal is described, in part, in terms of proposals for three specific projects². These projects are mutually supportive although they could, with one exception, operate alone or in pairs. The three projects are outlined in broad terms by the following summaries.

Mathematics/Sciences Matriculation Outreach Project

This 4½-year project (July 1982 through December 1986) aims to improve instruction in secondary school mathematics and the sciences. It will extend the development of a computer-based educational programme already begun by Control Data and designed to provide instruction in Standards 9 and 10 of the South African matriculation syllabuses for biology, chemistry, mathematics and physics. This PLATO-based product will be presented both in Afrikaans and English. Its intended users include secondary school students, school teachers, prospective university students, and adults involved in self-improvement in order to prepare for better employment opportunities. The budget of this project covers curriculum writing, teacher training in the use of the material, and

2. A fourth and "missing" project involving an Afrikaans language course is mentioned in a later section of this paper.

The Proposals

Details of the execution of each of the three projects are given in separate proposals⁴. In considering any one of them, however, the reader should bear in mind that each is an integral part of a unified plan to develop the instructional computing facility available at the University of the Western Cape. Thus, while each project may be viewed independently with regard to funding and to the tasks unique to the project, it is also important to see it as related to the other two and, hence, to the overall plan.

The principal thrust of the five-year project plan is to improve the teaching of secondary school biology, chemistry, mathematics, and physics. Due to the nature of the material being developed, the population to benefit from these improvements extends beyond the population of secondary school students to include secondary school teachers, university teachers, prospective university students, and adult students.

4. Copies of any one of these three proposals may be obtained by contacting Prof. A.J.L. Sinclair, The Teaching Centre, Private Bag X17, University of the Western Cape, Bellville, 7530. (Telephone: (021) 97-6161 X204.)

experimental implementation of the programme in four secondary school locations. The project can operate alone or in combination with either or both of the next two projects described.

Instructional Computing Services Dissemination Project

This 3½-year project (July 1983 through December 1986) is directed towards helping educational institutions make use of the PLATO facility at the University of the Western Cape. It will do this by providing both equipment and instructional services to secondary schools, technikons, and teacher training colleges of the Western Cape which wish to make use of PLATO on an exploratory basis. An institution's participation will last for two consecutive school terms; it will be contingent upon (a) staff/ administrative interest in computer-based instruction; (b) institutional commitment to the utilization of PLATO as part of instruction during the "test" period, and (c) staff willingness to undergo training in the use of PLATO. Continued use of PLATO beyond the two-term period would be at the individual institution's expense. The Dissemination Project budget covers staff training and equipment expenses for 8-terminal installations in up to 24 institutions over the period of the project. This project can operate alone or in combination with either or both of the other two projects described.

Computer Courseware Evaluation/Improvement Project

This two-year project (1985-1987) has two major goals: (a) to extend the work of Control Data in validating the South African secondary school PLATO courseware in mathematics and the natural sciences,³ and (b) to produce material, procedures, and a cadre of secondary school teachers which will guide the evaluation and development of PLATO courseware. Building upon Control Data's experience and established methodology in courseware development, the first goal accepts the general principle that secondary school teachers must participate in the definition and refinement of any new secondary

3. A curriculum in Afrikaans may also be included; see the section entitled THE "MISSING" PROJECT.

school curriculum if that curriculum is to be accepted, implemented, and designed to meet the needs of secondary school students. Thus, while tertiary level personnel (university staff and programming assistants) can contribute to the design and encoding of computerized lessons (such as those proposed in the Mathematics/Sciences Matriculation Outreach Project), such new courseware needs to be evaluated by those persons who are engaged in the initial instruction of the topics included in the curriculum concerned. In short, the curriculum must be **validated** at the instructional level to which it is directed. To accomplish this, secondary school teachers with PLATO at their disposal for use with students will be given training in the unique task of evaluating computerized instructional material. In addition to making editorial notes on minor changes, these evaluators will be responsible for the identification of major conceptual problems in lesson development and for the suggestion of alternative developments of the lesson. Actual modifications of the programmes will be carried out by special Project staff charged with design and programming responsibilities. Moreover, the evaluation materials and procedures resulting from the review of the curricula in mathematics and the sciences should be applicable not only to the continued development of those subjects but also to the development of computerized curricula in other subject areas. Since this project will use existing PLATO equipment, its budget is primarily for human services: the training of evaluators, the time invested by evaluators in reviewing courseware, and the employment of lesson designers and programmers to effect the modifications needed. The project must be executed in combination with one or both of the preceding two projects; it cannot be implemented alone.