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NEWSLETTER

Edited by John King

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Planning Tomorrow's Tests

Research at ACER is laying the foundations for a new generation of educational tests that will be used into the twenty-first century. According to ACER's Assistant Director (Measurement), Dr Geoff Masters, future educational tests are likely to differ from most existing tests in three significant respects: they will assess a broader range of teachers' goals for students; they will capitalise on advances in theory to provide more useful reports of student learning; and they will make increasing use of advances in computer technology. He goes on:

We can imagine the day when, instead of taking a paper-and-pencil test of physics knowledge, students will interact with physics problems presented on a screen. They might be asked to apply 'forces' to objects on a screen to produce particular kinds of motion or they might observe simulated motion such as a ball rolling down a track and be asked to draw a distance-time graph to represent that motion. The computer will analyse the direction and size of the forces that students apply and the shapes of the graphs they produce to draw inferences about their levels of understanding of basic principles of force and motion.

While such tests may seem futuristic, Geoff Masters says that the research and technology they require are already with us. He points to the work of researchers such as Barbara White and Lillian McDermott in the United States who have computer-administered problems of this kind already in operation:

The big difference between these tests and the more traditional paper-and-pencil tests is that they will be designed not so much to produce right and wrong answers but to reveal the kinds of *thinking* that students are doing. In a project funded by the Australian Research Council we have developed fourteen different physics problems and, in cooperation with staff of the University of Melbourne, the Royal Melbourne Institute of Technology, and the Lincoln School of Health Sciences at La Trobe University, have spent hundreds of hours interviewing students to explore the

approaches that they take to these fourteen problems and their conceptions of the underlying physics. Our next step will be to explore ways of presenting these problems on a computer to reveal the kinds of misconceptions that we now know students have.

A Broader Range of Tests

Other work at ACER is aimed at developing tests for a broader range of learning goals. Geoff Masters says that while teachers have had access to professionally developed assessment materials for some aspects of student learning, for other important areas of learning teachers have been left to their own resources:

In mathematics, for example, teachers have access to a wide range of materials for assessing students' knowledge of facts, mastery of skills, and abilities to carry out standard applications of mathematics learning. But problem solving is also an important part of mathematics curricula. In this area, good assessment materials are scarce. Our approach has been to seek out

mathematics educators who are working in this field and to invite them to work with us. This collaborative work will produce new materials for assessing students' abilities in mathematics problem solving. We see a similar need for assessment resource materials in other areas of school learning. In many cases, these materials will be very different from traditional paper-and-pencil tests.

Item Response Theory

Geoff Masters says that another feature of future ACER tests is that they will make greater use of a statistical technique for the analysis of test data known as *item response theory* (IRT). The advantage of IRT procedures is that they are capable of providing teachers with more informative ways of interpreting test results and of diagnosing students' strengths and weaknesses:

A widely recognised shortcoming of many standardised tests is that they provide only norm-referenced interpretations of student performance: that is, they interpret students' results only in terms of the performances of other students. Item response theory provides a way of interpreting test

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ACER's Assistant Director (Measurement), Dr Geoff Masters. Teachers and researchers interested in further discussions with Dr Masters should contact him at ACER: (03) 819 1400.



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results not only normatively, but also in terms of the kinds of knowledge, understanding and skill that individuals have achieved. In our work with several state departments and ministries of education we are using item response theory to monitor and describe standards of achievement in schools and to provide teachers and parents with detailed reports on the progress of individual learners. At the same time, we are working to make these test analysis techniques accessible to teachers on microcomputers so that teachers will be able to extract maximum information from their own classroom tests.

Computerised Testing

To develop this new generation of tests, staff of ACER's Measurement Division are proceeding one step at a time. The first step is to make some of ACER's existing test materials available to schools on computer disks. Initially, teachers will be able to purchase from ACER several hundred algebra test questions on disk. These will be displayed in an accompanying book. Teachers will be able to preview individual items on a screen, select the items they wish to use, re-order them if necessary, and automatically print the master copy of their algebra test ready for photocopying. The second step will be to provide test items that can be administered by computer:

In a computer adaptive test, a student sits in front of a computer and answers questions as they appear on the screen. The computer keeps track of the student's success rate and selects items appropriate to his or her performance. In this way, each student receives a test tailored to their current level of achievement. During the next twelve months we expect to begin implementing computer adaptive testing in at least one tertiary institution as part of that institution's program of diagnostic mathematics testing.

Geoff Masters sees the next few years as an exciting period for the work of ACER's Measurement Division as staff work to capitalise on new possibilities opened up by advances in measurement theory and computer technology:

Over the coming months we will be seeking out teachers and researchers capable of working with us to expand our range of educational tests. We expect that some of the instruments developed in this way will be highly innovative and will address aspects of student learning not well assessed by existing materials. For many areas of the school curriculum there is a need for new approaches to assessment — not only in this country, but overseas as well.

Literacy and Numeracy in Victorian Schools

Schools have many critics quick to claim that standards in literacy and numeracy are declining. Both critics and defenders of the educational systems usually have little more than anecdotes on which to base their claims, but each anecdote can be countered readily with an opposing one.

ACER's recently published report, *Literacy and Numeracy in Victorian Schools: 1988* provides clear evidence that standards have not declined over the last fifteen years. In the study on which the report is based, scales of performance were defined for numeracy, reading and writing separately, and state-wide samples of Year 5 and Year 9 students were measured with them.

The results for numeracy are shown in the figure. The line up the middle is the performance scale, from easy tasks at the bottom to difficult tasks at the top. The arrowheads on the right indicate the difficulty levels of the various items in the Year 9 test, while the arrowheads on the left indicate the difficulty levels of the items in the Year 5 test. The large dots on the scale show the difficulty levels of items common to both tests. Full details of the items are provided in the report. The distribution of levels of performance of Year 9 students is shown by the curve to the right and that of Year 5 students by the curve to the left. There is obviously considerable overlap in the distributions. About 6 per cent of Year 5 students, for example, perform above the mean performance of Year 9 students.

Similar scales and associated distributions of performance levels are provided in the report for reading and writing. Minimum acceptable levels of performance for adults in Australia were defined for each scale, and the proportions of students achieving above these levels were calculated. In addition, comparisons were made with achievement levels obtained by Victorian students in national studies of numeracy and literacy made in 1975 and 1980. The main results of these analyses are summarised below.

Numeracy

In Victoria, 94 per cent of Year 9 students and 52 per cent of Year 5 students achieve above the minimum

level of numeracy necessary for adults in Australian society. That is, they can at least carry out everyday mathematics tasks like calculating change from whole dollars, reading a meter, estimating distances on a map, and performing simple calculations like $125 \div 5$ and 38×9 .

In comparison with 1975 and 1980:

- At Year 5, overall standards have been maintained while the standards of lower ability students have risen consistently over the thirteen-year period since 1975.
- At Year 9, performance levels are significantly above those achieved in 1975, although there is some evidence that they have slipped back slightly from the higher levels achieved in 1980.

Reading

In comparison with 1975 and 1980, at both Year 5 and Year 9 there has been no decline in standards despite a considerable increase in the proportion of students from non-English-speaking backgrounds.

- 77 per cent of Year 9 students and 21 per cent of Year 5 students achieve above a level in reading that requires relatively complex inferences from text, such as reading twenty-two lines of prose and judging whether the writer's main purpose was 'to entertain the reader', 'to write very beautifully', 'to weave a lesson into the story', or 'to give some useful information'.
- 95 per cent of Year 9 students and 52 per cent of Year 5 students achieve above a level in reading that requires simpler inferences from text, such as judging the night to be cold from the following sentence within twelve lines of prose: 'Wrapping his warm cloak closely about him, a sentry on the furthest outpost stamped restlessly'.

Writing

In writing, 92 per cent of Year 9 students and 56 per cent of Year 5 students achieve above a level that involves taking and writing messages, and writing straightforward letters such as those requesting information.

The Centre of Philosophy for Children

The Centre of Philosophy for Children has conducted a large number of workshops, seminars and awareness sessions since August 1988. This trend looks set to continue as educators become increasingly aware of the potential of philosophy for children in such key areas as thinking, reasoning and self-esteem.

In July, ACER and the Centre will host a visit by professors Ann Sharp and Ron Reed of the Institute of the Advancement of Philosophy for Children in the United States. Both professors are at the forefront of philosophy for children worldwide; Ann Sharp is the coauthor of the novels and teacher manuals which constitute the program, and Ron Reed heads the Centre for Analytic Teaching in Texas. They will conduct a six-day workshop for philosophers and teacher educators at Lorne, Victoria in July. In addition, they will take part in a number of public sessions (including the Awareness Session on 1 August, as indicated below in the Forthcoming Activities section).

September Conference

The Centre is also organising a conference on the Teaching of Critical and Creative Thinking on Friday 1 September. The Minister for Education, Joan Kirner, will give the opening address. Participants will also take part in workshops related to the conference theme, and an evening panel session entitled 'What role do critical and creative thinking play in high quality teaching and learning?'

Sponsorship

The Centre is currently seeking sponsorship for various programs and activities. ACER gratefully acknowledges the generous donations offered by Mr Peter Kolliner and Mr Joe Pasmanik (Australian Textile Printing Co.); Mr Graeme Samuel, Mr Neil Samuel and Mr Chris Siddons (Ramset Fasteners). We are especially grateful to Australian Airlines for their generous support in connection with travel to and from the July workshop for teacher educators.

Forthcoming Activities: Workshops, Conferences . . .

August 18-19: Introductory workshop on the program *Wondering at the World* and the novel *Kio and Gus*; helps primary

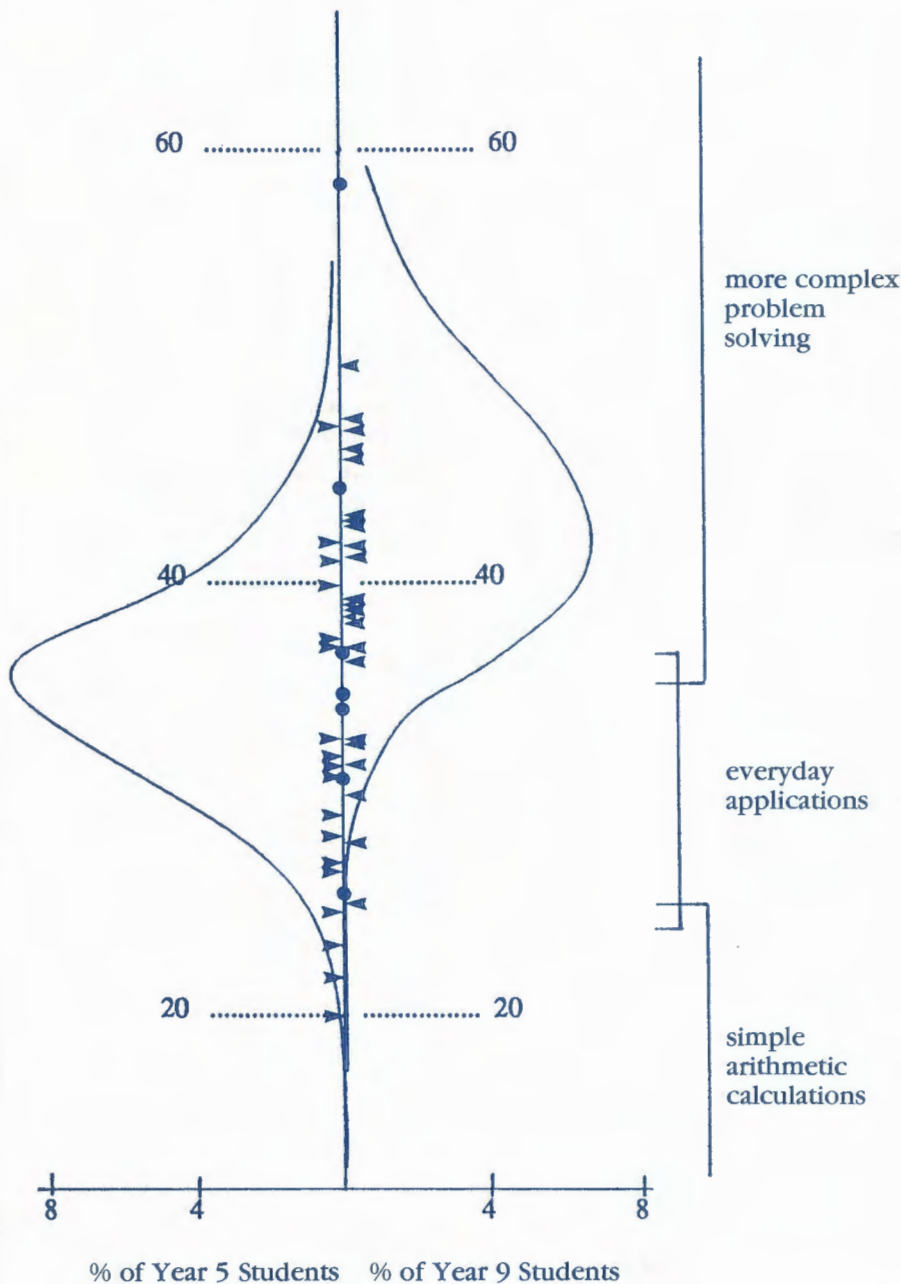


Figure 2.1 Distribution of Student Achievements on Mathematics Scale

In comparison with 1975 and 1980:

- At Year 5, there was a marked improvement in letter-writing performance but a decline in report-writing skills and, on a task that involved writing a caption and title for a cartoon, an increase in the rate of spelling errors from around five per hundred words written to around six per hundred words written.
- At Year 9, there was a decline on tasks such as taking and recording messages and in some aspects of letter writing, but no change in the rate

of spelling errors which remained at between two and three words in every hundred used in essays.

Further Studies by ACER

The Victorian Minister for Education, Joan Kirner, has announced that the 1988 survey of literacy and numeracy levels in Victoria will now be followed up by further ACER studies: science in 1990, social studies in 1992, and literacy and numeracy again in 1993.

The report, including the full tests, is available from ACER. See the *New from ACER* leaflet.

school children to think and reason about nature; an ideal introduction to science and environmental education.

September 1: Conference on *The Teaching of Critical and Creative Thinking*.

October 2-3: Introductory workshop on the program *Looking for Meaning* and the novel *Pixie*; builds primary school children's reasoning and inquiry skills, particularly in reading comprehension, language and meaning.

November (dates to be finalised): Proposed workshop on the core program *Philosophical Inquiry* and the novel *Harry Stottlemeier's Discovery*; focuses on the basic reasoning tools (including critical thinking and logic) that Years 6-8 children

can subsequently apply to specific problems in science, mathematics and the humanities.

Monthly A series of 'awareness sessions' on philosophy for children: These sessions will include a talk by one or more members of the Centre, and a chance to participate in a demonstration 'community of inquiry'. They are designed for teachers, parents and others interested in finding out what philosophy for children has to offer.

There will be no charge for these sessions but you will need to advise the Centre if you are interested in coming along. Please contact The Centre of Philosophy for Children at ACER (03) 819 1400 for further details or complete the form on the back page of the *New from ACER* leaflet.

The dates of the awareness sessions for the second half of the year are as follows:

Tuesday 1 August at 7.30 pm
Wednesday 20 September at 4.15 pm
Thursday 26 October at 4.15 pm
Monday 20 November at 7.30 pm
Each session is self-contained and will last about 1½ hours.

*Professors Ann Sharp and Ron Reed of the Institute for the Advancement of Philosophy for Children in the United States will be present at this session, and will speak about international developments in philosophy for children. Early booking for this session is advised.

Please note that these awareness sessions are not adequate preparation for teachers intending to teach philosophy for children programs.

The Sunrise Community is Growing . . .

Since early in 1988, a class of students has been working in the Sunrise School in the heart of the Museum of Victoria for the equivalent of one day per week. These students are the pioneers of the joint project established by the ACER and the Museum to research the use of technology in education. They, and their teachers, are committed to being with the Sunrise School for three years. In that time it is hoped they will develop a role for technology based on the assumption that it is a useful tool for humans, but which goes beyond that assumption to make technology part of an extended medium for intellectual activity.

The Sunrise School students are now reaching the stage where they have achieved a strong sense of independence in planning their learning, and this places a heavy demand on their teachers for curriculum development. Fortunately, the teachers at the Sunrise School are not alone. There is a Sunrise class at a Melbourne girls' school and several others are planned to start in other states.

Educational Research

The Sunrise School and centres are supported educationally by a number of projects. In direct response to the teachers' growing need for help in using technology in the Sunrise way, a pilot project in mathematics has been commenced at ACER. This project will investigate artificial, computer-based 'transitional objects' as metaphors which may act as bridges linking students' naive understandings to con-



Student and teacher participation in the Sunrise class at a Melbourne school for girls.

ventional mathematics. This work is being done initially with Logo. An advanced computer medium for this work will be provided at a later stage by another Sunrise Group project, the development of the computer environment Boxer (in association with Professor Andrea diSessa at the University of California at Berkeley). In the meantime, a Telecom-sponsored initiative will bring six educational scholars to Australia for work with the Sunrise community. Telecom will make it possible for researchers in all states to participate with these scholars in teleconferences, in which participants hear and see each other simultaneously.

Staff Appointments

In 1989 Andrew Brown, well known in Victoria for his work showing that technology can significantly improve

students' learning opportunities for making music, joined the Sunrise Group. Andrew is sponsored by Roland Australia and will be developing materials for teachers and students with technology cast in this role.

Sunrise Outreach Program

The curriculum ideas for the Sunrise centres will not be confined to those directly involved. Peter Adams, until recently a computer education consultant with the Victorian Ministry of Education, has joined the Sunrise team to develop the Sunrise Outreach Program. Peter's interests and experience equip him appropriately to provide professional development activities for teachers, which will make the Sunrise facilities available to schools generally.

The emphasis in the Sunrise Outreach Program will be integrating the Sunrise activities with the vast resources of the Museum of Victoria. Teachers who attend these courses will be able to bring their students back to the Museum for work with the general collections and within the Sunrise School. A course outline and timetable is available for terms 3 and 4 of 1989.

What lies ahead for all involved is the task of making explicit their understanding of what is being done and what can be done. In the words of one student from the Sunrise School:

I have probably learnt stacks of things unconsciously but I'll just name a few I've learnt consciously:

- Logo
- how you make Lego with a motor move
- things about sensors
- computer language and commands

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Teachers' Professional Craft Knowledge

One of the projects currently underway at ACER is an investigation of teachers' professional craft knowledge. The aim of this study is to enable teachers to articulate, develop and share their professional craft knowledge. By *craft knowledge* is meant the knowledge and expertise that teachers acquire and apply in their day-to-day experiences in the classroom.

Because teachers often teach in isolation from each other, they are not accustomed to putting into words what it is they do in the classroom that seems to work well. If teachers can be encouraged and helped to identify and reflect on the positive aspects of their teaching and to articulate their professional craft knowledge, they may provide us with a clearer insight into the nature of effective teaching, enhance their own teaching, and establish a basis for sharing their knowledge with other teachers through school-based professional development.

This approach to teachers' professional development is based on the premise of building on strengths rather than remedying deficiencies. Another feature of the approach is that it does not start from any particular theoretical position or attempt to impart a set of guidelines; the starting point is the teacher, and the professional development framework will be developed jointly by teachers and researchers.

The study is planned in five stages:

1. Identifying the qualities that students value in their teachers and that teachers value in their own teaching.

2. Observing the classes of some of the teachers who display these qualities, followed by teacher reflections on the positive aspects of their teaching in the observed lessons.
3. Working with the participating teachers to develop strategies that will facilitate the sharing of craft knowledge among teachers.
4. Trial testing of professional development strategies within single schools or clusters of schools.
5. Producing guidelines for practitioners on using the strategies for school-based staff development.

This study will focus initially on Year 9 in two schools within a Victorian region. The Year 9 level was chosen because it is regarded by many educators as the most difficult school year for both students and teachers, and therefore it would be an appropriate target for professional development activities. The study will concentrate on three subject areas: humanities, science/mathematics, and practical studies. Further details may be obtained by contacting the project director: Margaret Batten, Senior Research Officer at ACER.



Dr Margaret Batten, Director of the Teachers' Professional Craft Knowledge project, is also the author of *Year 12: Students' Expectations and Experiences* – a study of alternative forms of post-compulsory education.

Sunrise Community continued from page 4.

Financial Supporters

The Sunrise School, the Sunrise Outreach Program, the Boxer and Music projects, and Sunrise centres are all united by the Sunrise Central Group. The Sunrise Central Group is supported financially by the Victorian Ministry of Education, the Telematics Trust, Apple Computer Australia Pty Ltd, Roland Corporation Australia Pty Ltd, Telecom Australia and the Metropolitan Transit Authority.

Further inquiries about the Sunrise Central Group or the Sunrise Outreach Program should be made to Judy Ballantyne, Administrative Officer of SCG, phone (03) 819 1400.

Change to ACER Council

ACER is a non-profit-making company, governed by a council which currently meets twice each year. At its last meeting, the council decided to reduce its size from twenty-seven to thirteen members, and to alter its structure in the following way:

- Nominees of the state directors-general of education – current membership one, proposed two
- Secretary of commonwealth department or nominee – current membership one, proposed one
- Chair of the National Board of Employment, Education and Training or nominee – no membership currently, proposed membership one
- Nominees of the state institutes of educational research – current membership eight, proposed two
- Members elected by council – currently fourteen, proposed five
- Elected ACER staff members – currently two, proposed one
- Director of ACER – remains a member

These changes are now being incorporated into a revision of ACER's *Memorandum and Articles of Association*, which will be formally adopted by the council at its next meeting in October 1989.

The twenty-seven members on the present council include eleven who are senior officials in government departments of education, but only two are *ex officio* members of the council. Under the new arrangement, four of the thirteen members will be nominated as government representatives, since that proportion better reflects the level of government financial support for ACER. The annual core grant to ACER from the commonwealth, state and Northern Territory governments has, in recent years, provided about one-third of ACER's income. In the current financial year, the proportion provided by the core grant has dropped to one-fifth because ACER has considerably increased its income from other sources.

Reports from the Institutes for Educational Research

New South Wales

Controversial issues have been the focus of a number of recent activities of the NSW Institute for Educational Research.

Reports and workshops concerning the *Integration of the Disabled in the Regular Classroom* were presented at an exciting conference which attracted over 200 participants. The contribution of a number of speakers, including Peter Tarr, Pat Doherty and James Ward, is to be published shortly.

Dr Geoff Masters, Assistant Director at ACER, spoke to a well-attended recent meeting on the subject *Recent Developments in Testing: Help or Harm to Education?* Some lively exchange between Dr Masters, three respondents and some of the 150 audience followed this address.

Future meetings will include a conference addressed by Professor Marie Clay and Professor James Ward, *The Prevention of Reading Failure* (July 21). *Education Towards 2000: Common Values in a Diverse Society?*, which includes articles by Professors Manning Clark and Eric Willmot, is soon to be published.

For further information contact Dr Alan Watson, Sydney College of Advanced Education, PO Box 88, Oatley, NSW 2223; Telephone (02) 570 0709 or Fax (02) 570 0864.

Queensland

Meetings held by the QIER have been well attended. Presentations have included *Using SYSTAT in Education* by David Chant, University of Queensland, *The Curriculum Future for Queensland Schools: Balancing the Pressures?* by Mike Middleton, Ministerial Consultative Council on Curriculum, and *Issues in Senior Secondary Education* by Ken Imison, Board of Senior Secondary School Studies.

The J.A. Robinson Memorial Lecture will be presented on 10 August 1989 by Professor Diana Davis, Professor of Education, James Cook University of North Queensland. Professor Don Watts, President and Vice-Chancellor at Bond University, will speak at the Annual General Meeting on 21 November 1989.

The first issue (Volume 5, Number 1) for 1989 of the Institute's Journal *Queensland Researcher* has been dis-

tributed with the second issue planned for July.

Further information about the Institute's activities and publications is available from Neil Cranston, Secretary, QIER, Department of Education, PO Box 33, North Quay, Queensland 4002; Telephone (07) 237 0968.

Fifth World Conference on Computers in Education

The Fifth World Conference on Computers in Education (WCCE/90), organised under the auspices of the International Federation for Information Processing (IFIP), will be held in Sydney, 9-13 July 1990.

Held only every five years, WCCE is the major international conference in the computer education field. WCCE/90 will be a conference for all aspects of computer-related education in all education environments.

For full details contact: WCCE/90, PO Box 319, Darlinghurst, NSW 2010.

Mathematics and Microworlds Course

Presented by the Sunrise Central Group; Melbourne, 25-27 September 1989

Professor Uri Leron of the Israel Institute of Technology, who is well known for his work with Logo and senior mathematics students in upper secondary and tertiary levels, will be the guest speaker at this course.

The focus of the workshop will be on using Logo microworlds for mathematics education. Participants will work with other teachers and teacher educators in workshop sessions. Hands-on Logo activities will be included.

Application forms are available from: The Administrative Officer, Sunrise Central Group, ACER, PO Box 210, Hawthorn, Vic. 3122.

Overseas Publications

Scottish Council for Research in Education

Stress in teaching: An overview of research by Margaret Johnstone – a succinct survey of studies on stress in relation to teaching, centring round British research. (approx price \$11.00)

Education in Transition: What Role for Research? – twelve eminent researchers turn their attention to major aspects of education today, and demonstrate the relevance of research, whether seen as 'instrumental' or 'for enlightenment'. (approx price \$21.00)

National Foundation for Educational Research – Nelson

Appraisal of performance – An aid to professional development by J. L. Jones and J. R. Mathias – shows how to introduce a full teacher-appraisal program into schools, based on an evaluation; draws out information for staff development, identifying training needs and preferences. (approx price \$120.00)

The Portage Classroom Curriculum by Joan Bruckerhoff and the Portage Project Staff – designed for use with all children, not just special needs groups, it extends individualised teaching to the classroom. Comprises a Checklist, Instructional Units and an Administration Manual.

These publications are available by the special order system placed with ACER Customer Services. Further information about SCORE, NFER-Nelson and the New Zealand Council for Educational Research publications is available from ACER.

National Evaluation of PEP

John Owen, a member of the ACER's theme advisory committee on Teachers in Australian Society, has been involved in a series of case studies on the national Participation and Equity Program (PEP).

The findings are outlined in two volumes edited by John Owen and Robyn Hartley: *Case Studies in Seven Schools* and *Case Studies in Five TAFE Colleges*. Both are available from the Centre for Program Evaluation, Institute of Education, University of Melbourne, Parkville, Vic. 3052. Each volume costs \$15.00.