HERDSA NEWS

The Higher Education Research and Development Society of Australasia

I.S.S.N. 0157-1826

VOL. 6 No 3

NOV. 1984

RESEARCH ON STUDENT LEARNING —PART 1

FEATURES

REGULAR ITEMS

Editorial

We have felt for some time that HERDSA could do more to make known to its members research on issues in tertiary education. One way that this may be achieved is to include in HERDSA NEWS short articles summarising particular areas of research and showing how such research would be of value to practitioners in tertiary education. The articles would present the results of the research in a readable format and would list the references which would provide a good introduction to that particular area. We would hopethat many tertiary teachers would find ideas which would challenge their current teaching practices, and that some would be induced to conduct research of their own in the area.

In line with this philosophy, this special issue of HERDSA NEWS presents the first three of a series of commissioned articles on RESEARCH ON STUDENT LEARNING. Other articles in the series will appear in subsequent issues. The series is extending the research orientation established in one or two of the articles in the earlier, very successful LEARNING SKILLS series (November '82; March, July '83).

Research on student learning has been receiving increasing attention over recent years and the articles in our present series have been commissioned so that each focuses on a different research perspective. In this issue we have a review of problem solving research and its implications for tertiary teaching, an article on cognitive structure research and its implications for learning subject matter in tertiary education and one on students' preferences in the ways they process knowledge and the implications for course design.

The research reported is a long way from the stimulus-response, behaviourist research many associate with research on learning. Although such research has provided a basis for some innovations in tertiary education (e.g. Keller Plan or Personalised System of Instruction, Mastery Learning and some aspects of Computer Assisted Learning) nevertheless it has often seemed to be divorced from the real problems faced by teachers and learners in tertiary education trying to teach or learn difficult and substantial bodies of knowledge, complex skills and problem solving strategies. The stimulus-response approach was often referred to by its detractors as the "rats-and-stats" approach and was characterised by the use of fragmented, simplistic or nonsense learning tasks and artificial laboratory settings. Not surprisingly, for many problems in areas of higher education, the behaviourist research on learning seems to have supplied few answers or even possible solutions.

Over the last decade, many researchers have begun to focus on real tertiary students learning real bodies of knowledge, and developing real problem solving skills. There has been a change from the view of the student as a black box to a view of the student with active cognitive processes engaged in interaction with the subject matter. This has entailed, in many cases, changing perspectives from solely theoretical research on student learning to research combining both theoretical and practical aspects, and focusing to a larger extent than previously on the subject matter that is being learnt and how this interacts with individual student characteristics.

In the first article, Barry McGaw and Jeanette Lawrence raise several issues about student problem-solving abilities and strategies. For example, how important is prior knowledge when attempting to solve problems of consequence? Are there any differences between the strategies used by experts and novices? In the second, Leo West asks how and what students learn from courses teaching large bodies of disciplinary knowledge. From his analysis he concludes that what they are learning includes misconceptions about key ideas. This conclusion raises further questions about how we, as teachers, can deal with these misconceptions in our teaching. Is it our role to be concerned with what students learn, or just that we transmit appropriate disciplinary knowledge? Finally, Pinchas Tamir summarises and discusses recent research on students' learning preferences. He raises important questions concerning whether we should attempt to change these learning preferences, or individualise our courses to adapt to various preferences. He also asks whether some preferences are better or worse than others. These are important questions when one is considering adapting courses and teaching and learning methods to the ways students go about learning and studying.

We hope that these reviews of some of the research on student learning show that at least some of this research is focusing on the issues and concerns of real students in real classrooms trying to learn realistic subject matter, and that it raises questions in readers' minds about the way they teach and structure their courses.

In this on-going series we would welcome contributions from readers who wish to extend or challenge the research frameworks presented.

Elizabeth H. Hegarty,
Michael T. Prosser,
Guest editors.

NEW TELEPHONE NUMBERS FOR U.N.S.W. HERDSA EXECUTIVE MEMBERS

Recently the University of New South Wales has installed a new "third generation" PABX, which has resulted in changes to all telephone extension numbers. The following are the new direct dial telephone numbers for TERC, HERDSA'S agents and for executive members at the University of New South Wales:

TERC (HERDSA agents)	(02) 697-4937
John Powell (HERD editor)	(02) 697-4937
Dave Boud (HERDSA NEWS editor)	(02) 697-4933
Ian Dunn (Treasurer)	(02) 697-4558
Alan Prosser (Executive Member)	(02) 697-4432
Elizabeth Hegarty (Executive Member)	(02) 697-2099
Peggy Nightingale (Executive Member)	(02) 697-4943

Developing Expertise Through Higher Education

Universities and Colleges play an important role in the development of professional and academic expertise. Barry McGaw and Jeanette Lawrence review research on student problem solving and explore the connections with academic expertise. They characterise differences between the performances of experts and novices in terms of their representations of problems, solution strategies and control mechanisms.

Higher education is directed at the development of some form of expertise in intelligent novices. Academic teachers hope to initiate their students into knowledge and procedures which will form the basis of practice and research that, in turn, can grow into expertise. So it is reasonable to expect that recent developments in the study of expertise will be of relevance to higher education.

Expertise consists of practices and processes by which people are recognised as those who excel in a given field. Experts become absorbed in their chosen pursuits, developing a specialisation which is not easily transferred to other fields. Once out of the absorbing task, the expert drops back into the ranks of the ordinary performer. Voss, Greene, Post and Penner (1983), for example, showed that expert research chemists performed like undergraduates when dealing with a political science problem. None of this, of course, stops some advertisers from using champion tennis players to endorse cars or video machines, or some academics from seeking to speak with authority outside their domains. The aura of the expert is strong and moves across domains even if the skill does not.

Research on expertise represents a change in direction from the study of younger and slower learners to that of able and achieving professional adults. Of course, it also reflects the contemporary fascination with the efficiency of computers, since some of the research involves studies of artificial intelligence, but here we concentrate mainly on studies of human expertise. Making the educational pursuit of excellence explicit has the added advantage of helping us to determine ways of promoting more effective behaviours in students.

Expert problem solvers think about their chosen tasks in different ways from the less efficient, and recognise and activiate better routes to solutions. They manage their task-directed behaviours better by adapting to the demands of the task rather than pursuing entrenched, well-practised, but inefficient operations. We are beginning to put together a picture of what the practised expert looks like. The distinguishing marks of experienced and efficient problem solvers include the manner in which they represent problems, the forms of their solution processes, and the nature of experts' control over their own processes.

Problem representation by experts

People who already know a good deal about a domain of knowledge have well-tuned methods for representing information. They are much better than the less informed at recalling details of new information they acquire in their fields. Existing knowledge structures and implicit theories guide their interpretation, acquisition and integration of new information. Using textual material on baseball games, Voss and his colleagues have shown that baseball buffs' prior theories guide anticipations of what the text will say next, provide anchors for information to be held in mind as more text is read and facilitate recall of more elaborate details (Voss, Vesonder, and Spilich, 1980). Their interpretations thus do not arise solely from the data of the text, but also are products of the ways knowledge guides their reading. It is that capacity to blend the existing with the incoming of which expertise in part consists. The way in which a problem is represented similarly depends both on what is in the problem and on what is in the problem solver's head. Problem solving has both top-down (mental model driven) and bottom-up (data driven) characteristics.

Much that is written about the models in people's heads and the way in which they operate refers to them as "schemas", though that term is not used consistently or unambiguously. It may be more appropriate to speak in terms of "cognitive structures" or "mental models". (Johnson-Laird, 1983). Resnick (1983) describes schemas as being used to interpret familiar situations and to reason about new ones. In her terms, novices and experts differ in the content of their schemas and which make different things of the same experiences. Novices have naive models of the world which produce quite different expectations and interpretations from those of experts, and even those who have studied in a discipline may persist with inappropriate novice models. Physics students, for example, frequently use a quasi-Aristotelian interpretation of the movement of objects, persisting with this naive model despite instruction in Newtonian mechanics. This is true not just of students first learning physics but even of university graduates in physics (Gunstone and White, 1981).

Larkin (1982) provides a more precise definition of the unique features of the expert knowledge structures which account for the different representations of the same problem which experts and novices develop with physics problems. Novices build mental models with elements that are familiar visible entities of everyday experience. Their models have real sets of objects with moving parts. As time passes, they can "see" the objects moving in real time and space in their images.

While experienced physicists may build similar working mental models, their models can be qualitatively transformed to express the laws of physics with fictitious entities like force, and mass, rather than original visible entities. The expert's model clarifies the relationships among the entities, which facilitates the writing of mathematical relationships and leads to an appropriate solution. From Larkin's studies of experts working on very difficult problems rather than textbook exercises, it is clear that experts spend a good deal of time transforming their initial mental model into physics models which generate solutions. When a transformation produces an inadequate model that will not yield a solution, the expert returns to the naive model and applies different transformations to produce another model implying a different solution path.

Chi *et al* (1982) provide corroborative evidence of this. Experts' mental models contain abstract principles from

their particular domain of knowledge while novices' models contain the literal objects and explicit conditions of the problem statement. When asked to categorise various textbook problems, students who had completed their first university physics course grouped together problems with similar elements such as pulleys and weights or sliding blocks. Physicists teaching at the university grouped the problems according to the principles underlying their solution such as momentum or conservation of energy.

Voss's work with problems in social science reveals similar differences between experts and novices in that domain where representations of problems are less constrained than those in physics because their solutions rarely are incontrovertible. The problem representations of experts contained abstract principles, took account of interactions among sub-problems, and involved longer chains of causal reasoning to back up assertions (Voss, Greene, Post and Penner, 1983).

Lesgold (1982) investigated expert/novice differences on a task with a substantial perceptual component. Expert radiologists interpret X-ray pictures in terms of specific components of the anatomy. When expert radiologists look at an X-ray, with their structured knowledge of principles of human physiology and body morphology, they can "see" the body. They can transform the two-dimensional image on the film into an appropriate three-dimensional model in their heads. Novices, on the other hand, see the film and interpret its features directly, because their models are essentially two-dimensional. They cannot see simultaneously two body structures projecting onto the same part of the film.

Experts' mental models contain abstract principles from their particular domain of knowledge while novices' models contain the literal objects and explicit conditions of the problem statement.

These various descriptions of expert and novice problem representation presume an automatic interaction of mental models with data. Lawrence's (in press) analyses of the differences between novice and expert magistrates reveal a more deliberative process with magistrates' presuppositions and frames of reference, such as their sentencing objective and their view of the crime, influencing not only how they interpret the data but which data they choose to use. The experts could extract more relevant information from case files and make more complete inferences from the same file data. The work with magistrates suggests that information selection is as important a feature of expert problem representation as is information transformation.

In summary, the representations of experts are more abstract than those of novices, because they transform original data out of rich knowledge of their domains. They also may take time to produce solutions. Confronted with a difficult problem, experts spend time developing appropriate qualitative models before moving to any empirical solution. Although novices' solutions also are driven by their cognitive structures and not just by the problem, their structures are less complete, less coherent and at a lower level of abstraction.

Despite all of this evidence about the common features of the representations of experts, there is also evidence of marked and consistent variation among experienced individuals in their preferred form of representation. Cowan (1977) found structural engineering problems being solved successfully with varying representations. Experienced magistrates differ in their analyses of cases and sentencing styles (Lawrence, in press). Though superior representation of a problem does characterise expert behaviour, there may still be important differences among experienced people in the form of the representation they use.

Solution processes of experts

Experts generally solve problems more quickly than novices but, more significantly, their increase in speed is an indicator of other differences. Speed is due partly to more appropriate representation of the problem, though not necessarily to faster representation since novices sometimes give little time to initial setting-up phases. Novices take smaller and more deliberate steps, while experts chunk their steps.

Gentner (in press) shows that more than automaticity is involved in the faster performance of experts. His slow motion videos show that outstanding typists use different hand movements from those of less expert, high-speed touch typists. There are variations among the experts in the form of their movements but they all involve highly efficient and overlapping sequences for frequently occurring patterns of letters.

Direction of processing is a second characteristic difference of expert and novice solution strategies. After early evidence of the appropriateness of means-ends analysis (Newell and Simon, 1972), Simon and Simon (1978) claimed that a means-ends strategy characterises novice performance, while a forward-working strategy characterises that of experts. Sweller, Mawer and Ward (1983) note the same difference and also show problem solvers switching from a means-ends to a forward chaining strategy as expertise develops.

The expert forward-working strategy flows directly from appropriate problem representations. With tasks involving a chain of equations linking givens to an end unknown, experts start with the givens and proceed through the chain. Novices first construct the required chain by working backwards from the unknown end. Experts also work forward on novel and difficult tasks for which there is not a simple chain of equations. Larkin's (1982) expert physicist worked forward on a difficult problem until he reached an impasse. Then he did not revert to a backward working means-ends analysis, but returned to the original question, developed a different representation of the problem, and worked forward again.

Novices take smaller and more deliberate steps, while experts chunk their steps.

Although much current research is based on strong assumptions that relevant domain knowledge is essential to solutions, earlier work pointed out the risk that too narrow a focus on the immediately relevant could produce a crippling inflexibility. Such functional fixedness can be avoided only by setting aside immediate representation in order first to work out what the present problem requires to remove its difficulty (Duncker, 1945). In Australia, the bush doctor and carpenter had to adapt what was available to meet immediate needs until the bullock team arrived. The museums of Kalgoorlie bear

witness to the adaptive functions that remote pioneers gave to materials at hand. This same flexibility is needed in all problem solving. If a routine procedure will work, it is not a problem which is being faced. While experts may have their preferred styles for representing a problem, and while they may find it difficult to switch representations when their preferred one does not work, key features of expert problem solving are flexibility of approach and a willingness to suspend habitual or otherwise preferred strategies.

An emerging body of research on the combination of running adaptations and deliberate control mechanisms indicates the importance of understanding more about management aspects of how experts work.

Expert control of processing

Expert solution processes then are automated, forward working, complex and flexible. Yet a further characteristic which distinguishes expert and novice problem solving is the control of processing. Use of automated processes itself is one form of superior control because the automatic steps occur consistently and predictably. Superior knowledge of appropriate moves ia another since it yields the superior solution steps that can be applied when conscious processing is used. This superior executive control of the experts may be matched by a superior awareness of the solution processes themselves. Little investigation of this metacognitive dimension of problem solving has been undertaken, but Lawrence's (in press) analysis of expert magistrates' accounts of their own frames of reference highlights the form of their conscious control over data selection processes. Duncker's (1945) identification of suspension of judgment to avoid functional fixedness points to the superior control over processing that can be expected of the very able.

Pitt (1983) and Svenson (1982) found that failure to identify problem demands and constraints was related to immature, less effective strategies. Subjects who could suspend operations until conceptual work had been done were more effective in the long run. Hayes-Roth and Hayes-Roth (1979) called this type of over-all, conceptual work "metaplanning". But not all control of work need occur at the beginning of a task. Adults and aware adolescents can use on-the-job, deliberate re-direction strategies. Adaptive, opportunistic planning, such as Hayes-Roths identified, are evident in the way university women and high school students plan to carry out errand tasks (Volet, Lawrence and Dodds, 1984). Efficient planners chunk tasks, consciously order priorities for better effects, and sacrifice coverage and enjoyment for efficiency.

An emerging body of research on the combination of running adaptations and deliberate control mechanisms indicates the importance of understanding more about management aspects of how experts work. Allocation and adaptation of attention, time and effort can produce more effective study skills, and Brown and her colleagues have demonstrated that such skills can be taught to college and school students (Brown, Bransford, Ferrara and Campione, 1984; Brown, Campione and Day, 1981). Volet's research at Murdoch is revealing that undergraduates with poor learning strategies have accompanying difficulties in reflecting on their study deficiencies. Metacognitive understanding and responsive study strategies seem to be related, although the point of entry to the action-reflection cycle is yet to be uncovered. There is an open area for research and instruction, connecting the developmentalists' concerns about adaptive and deliberate control of skills with cognitive science's study of adult and machine efficiency.

Implications for tertiary teaching

The implications of expertise research for higher education are related to the mental models we assist our students to develop, the ways beginning knowledge is structured, and the kinds of instructional interventions that we employ. If experts have more comprehensive schemas and transformational rules than novices in a discipline, can we help initiates to form better early representational models? If experts work faster, and with forward-looking operations, can we help trainees to automate their developing skills? If experts use more adaptive and deliberate control over their work, can we promote self-management of task-directed learning in our students?

The dominant assumption in higher education appears to be that domain-relevant knowledge and processes can be taught directly to the initiate, hence the emphasis on lectures and relatively routine laboratory exercises. We challenge this. Frequently the instructional focus is on the domain knowledge with an untested assumption that the initiates will learn ultimately to structure and use it as experts do. However before teaching sophisticated, discipline-based models and procedures to students, we should know what they involve, and we should know what kinds of alternative student models will be shaping the reception of our words and demonstrations of wisdom.

Instructors should not assume that students either begin or even continue with the same models as the teacher. A study of a group of advanced university students' schemas for study tasks in a single unit shows that the lack of congruence can occur between teacher and student even in the understanding of a course's purposes (Dodds and Lawrence, 1983). Four external students classified course topics according to their personal needs and interests with complete disregard for the integrative and chronological structure of the course. Because of their interests and social and employment constraints, each of them represented the same course content in her own way. Their assignment choices fell out of these repesentational systems.

Methods for identifying students' models differ in their economy and sensitivity. In experimental science at least, the teacher may use a method we are finding effective. It involves having students predict what will happen in a foreshadowed experiment and state the bases of their prediction. After seeing the experiment the students describe what they observed and offer an account for any conflicts with their predictions. The language and concepts

The dominant assumption in higher education appears to be that domain-relevant knowledge and processes can be taught directly to the initiate, hence the emphasis on lectures and relatively routine laboratory exercises. We challenge this.

that some trainee teachers used to describe chemical reactions gave important clues to the form of their naive models. A typical feature of the descriptions of chemically naive students is the description of chemical changes as physical ones (e.g. accounting for the reaction of sodium with water as sodium dissolving in the water).

Cowan (1977) had students individually tape-record their attempts to solve engineering problems. Cowan then was able to diagnose strengths and errors at his convenience. A slightly different approach is to examine the detailed errors students make in response to structured interviews and to infer from them the precise deficiencies in their models. Hackling and Garnett (1984) provide such an analysis of students' misconceptions of chemical equilibrium. A more intensive strategy for probing the naive models of the novice is the clinical interview. If care is taken, the risks of influencing students' forms of words can be minimised, while their mental models and knowledge structures can be probed. Piaget (1975) warns, however, that it is hard to find a balance between influencing the accounts with one's own preconceived ideas and missing cues due to the absence of any directing hypotheses.

Once the form of the naive models is known, the question is how to displace or modify them. One strategy is to confront them directly. Others are to teach the experts' strategies or generalisable problem solving skills. In the case of the motion of objects, Champagne and Klopfer (1982) provide this confrontation for students through separate computer simulations of the motion of objects according to Newton's model and Aristotle's. Students can then gather their own experimental data for comparison with the predictions from the two models. In less structured domains this type of simulation may be more difficult but there are other ways of confronting students' interpretations. Collins' (1977) use of the Socratic dialogue may be as powerful even if more oblique and individualised. He challenges answers by proposing situations which are consistent with the answer given but do not satisfy all the criteria necessary for an adequate answer to the question. Piaget's use of counter explanations provides a similar challenge to the adequacy of an answer and suggests another teaching strategy.

If we can identify the students' naive knowledge, instructional systems will have a better chance of being effective. One strategy is to teach the experts' method of representing the problem. Larkin (1979) raised undergraduate physics students' peformances by teaching them explicitly a physicist's representation and chunking procedures. In another study taeching principles of direct electric current circuits, an experimental group, taught how to construct representations, showed marked superiority in later problem solving over a control group which was given practice in generating relevant equations and combining them algebraically (Larkin, 1982). Riley (1984) obtained superior performance from subjects she taught to understand D.C. electric currents, not by using the type of representation a physicist would use but by using a concrete model of roulette chips fitted into slots according to some arbitrary rules. Riley claimed that crucial structural relations reflected in her model capitalised on the naive schemas of novices. It is not an analogy likely to be spontaneously drawn upon by students seeking to account for the behaviour of electric circuits, but rather it is an analogy explicitly contrived for the instruction.

Reif (1981) and Reif and Heller (1982) also argue for explicit instruction in problem solving skills. They suggest that the key is an adequate understanding of the cognitive components of effective problem solving such as how to generate a good basic and theoretical descriptions of a problem, how to analyse a problem qualitatively, how to decompose a problem systematically and how to evaluate solutions. This kind of understanding comes both from study of the strategies of experts and from careful analyses of tasks. From this they develop a prescriptive approach to instruction, teaching expert solution steps to novices.

Bacon and Lawrence (1981) took the running commentaries used by family planning experts, and developed out of them an instructional package for general practitioners and nurses. The intricate identification of procedural and communicative steps not only gave the trainees clearer directions for their practice, but also provided an assessment system for training programmes.

These approaches to explicit instruction in problem solving skills can be contrasted with much educational practice which simply provides exercises for students in the belief that this gives the students practice in problem solving. Repetitive exercises may actually inhibit students' acquisition of knowledge about problem structures (Sweller *et al.* 1983). Over-learning of errors indicates the need for early diagnosis of inexpert processes.

Once the form of the naive models is known, the question is how to displace or modify them. One strategy is to confront them directly. Others are to teach the experts' strategies or generalisable problem solving skills.

In postgraduate education there is a stronger formal commitment to the development of experts than in any other area of higher education yet, even here, our methods are in need of review. The ancient apprenticeship model of initiation seems to have dropped out of much of postgraduate training in Australia yet it may offer an intimate exposure to the style and strategy of the expert not readily obtained in other ways. Apprentices can be provided with a wealth of exposure to on-the-job adaptations by the experienced practitioner. Australian postgraduates often are expected to become experts by themselves on unique problems within four years of independent work. How effectively such a goal can be achieved is worthy of careful investigation.

All this does not mean that the path from beginner to leader of the field is easily executed or promoted by acaemic education. Lesgold's differentiation of intermediate levels of efficiency suggests that novices are neither automatically nor quickly turned into experts. What we can say is that greater understanding of both expert and novice representational systems and solution and control processes can form the basis of new directions in higher education. Our times demand greater adaptability in professionals and academics, even in the use of modern information systems. Our case is that domain-related adaptability can be prompted earlier and more systematically in universities and colleges.

Barry McGaw,
Jeanette Lawrence,
Murdoch University.

References

Bacon, J. & Lawrence, J.A. (1981), Towards the development of an instructional model for family planning clinical practices. Perth: Murdoch University. (mimeo)

Brown, A.L., Bransford, J.D., Ferrara, R.A. & Campione, J.C. (1983), Learning, remembering, and understanding. In J.H. Flavell & E.M. Markman (Eds.), *Carmichael's Manual of Child Psychology* (Vol. 1). New York: Wiley.

Brown, A.L., Campione, J.C. & Day, J.D. (1981), Learning to learn: on training students to learn from texts. *Educational Researcher*, 19 (2), 14-21.

Champagne, A.B. & Klopfer, L.E. (1982), *Laws of Motion: Computer Simulated Experiments in Mechanics. Teachers' Guide*. New Rochelle, N.Y.: Educational Materials and Equipment Co.

Chi, M.T., Glaser, R. & Rees, E. (1982), Expertise in physics problem solving. In R. Sternberg (Ed.), *Advances in the Psychology of Human Problem Solving (Vol 1)*. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Collins, A. (1977), Processes in acquiring knowledge. In R.C. Anderson, R.G. Spiro & W.E. Montague (Eds.), *Schooling and the Acquisition of Knowledge*. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Cowan, J. (1977), Individual approaches to problem solving. Glasgow: Department of Civil Engineering, Heriot Watt University. (mimeo)

Dodds, A.E. & Lawrence, J.A. (1983), Heuristics for planning university study at a distance. *Distance Education*, 4, 40-52.

Duncker, K. (1945), On problem solving. *Psychological Monographs*, 58 (2), Whole number.

Gentner, D. (in press), Expertise in typewriting. In. M.T.H. Chi, R. Glaser & M. Farr (Eds.), *The Nature of Expertise*.

Gunstone, R.F. & White, R.T. (1981), Understanding of gravity. *Science Education*, 65, 291-299.

Hackling, M.W. & Garnett, P.J. (1984), Misconceptions of chemical equilibrium. Perth: Western Australian College of Advanced Education. (mimeo)

Hayes-Roth, B. & Hayes-Roth, F. (1979), A cognitive model of planning. *Cognitive Science*, 3, 275-310.

Johnson-Laird, P.N. (1983), *Mental Models*. Cambridge: Cambridge University Press.

Larkin, J.H. (1979), Processing information for effective problem solving. *Engineering Education*, 70, 285-288.

Larkin, J.H. (1982), The role of representation in physics. In D. Gentner & A. Collins (Eds.), *Mental Models*. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Lawrence, J.A. (in press), Expertise on the bench: Modelling magistrates' judicial decision-making. In M.T.H. Chi, R. Glaser & M. Farr (Eds.), *The Nature of Expertise*.

Lesgold, A. (1982), Acquiring Expertise. Pittsburgh: Learning Research and Development Center, University of Pittsburgh. (mimeo)

Newell, A. & Simon, H.A. (1972), *Human Problem Solving*. Englewood Cliffs, N.J.: Prentice Hall.

Piaget, J. (1975), *The Child's Conception of the World*. Totowa, N.J.: Littlefield Adams.

Pitt, R.B. (1983), Development of a general problem solving schema in adolescence and early adulthood. *Journal of Experimental Psychology (General)*, 112, 547-584.

Reif, F. (1981), Teaching problem solving: A scientific approach. *The Physics Teacher*, May, 310-316.

Reif, F. & Heller, J.I. (1982), Knowledge structure and problem solving in physics. *Educational Psychologist*, 17, 102-127.

Resnick, L.B. (1983), Mathematics and science learning: A new conception. *Science*, 220, 477-478.

Riley, M.S. (1984), Instructional methods that make a difference: Structural understanding and the acquisition of problem-solving skill. San Diego, California: Institute for Cognitive Science C-015, University of California, San Diego.

Simon, D.P. & Simon, H.A. (1978), Individual differences in solving physics problems. In R. Seigler (Ed.), *Children's Thinking: What Develops?* Hillsdale, N.J.: Lawrence Erlbaum Associates.

Svenson, I.F. (1982), A process analysis of distance mathematics students' solutions of set exercises. Unpublished M.Ed. Dissertation, Murdoch University.

Sweller, J., Mawer, R.F. & Ward, M.R. (1983), The development of expertise in problem solving. *Journal of Experimental Psychology: (General)*, 112, 639-661.

Volet, S.E., Lawrence, J.A. & Dodds, A.E. (1984), Adolescents' organizational strategies for planning errands. Paper read at National Child Development Conference, Perth.

Voss, J.F., Greene, T.R., Post, T.A. & Penner, B.C. (1983), Problem solving skill in the social sciences. In G. Bower (Ed.), *Psychology of Learning and Motivation*. New York: Academic Press.

Voss, J.F., Vesonder, G.T. & Spilich, G.J. (1980), Generation and recall by high-knowledge and low-knowledge individuals. *Journal of Verbal Learning and Verbal Behavior*, 19, 651-667.

PROBLEM-BASED LEARNING CONFERENCE

Professor Don Woods, of McMaster University, will be visiting Australia as the 1985 HERDSA Fellow. He will be the keynote speaker at a conference on problem-based learning in the professions which will be held at the University of NSW on 30 and 31 March. The aim of the conference is to bring together people involved with courses which focus on the problems of professional practice rather than on discipline-based content, and to enable those with an interest in this approach to familiarise themselves with current developments.

The conference will consist of workshops and papers. These will describe existing courses; offer participants opportunities to work through problem-based materials; and to explore a variety of issues relating to the implementation of this approach within a single subject or an entire educational programme, course design, assessment and accredition, and factors concerned with teaching and learning.

Anyone interested in contributing a workshop or paper, or who would like further information regarding the conference, is invited to contact **John Powell, TERC, University of NSW, (02) 697-4937** as soon as possible. Details of the final programme and registration arrangements will be circulated early in 1985.

Learning Large Bodies of Discipline Knowledge

Leo West claims that something is wrong with higher education. Many students are passing exams and getting through the system with very superficial, and sometimes very wrong ideas of the major concepts of our disciplines. Useful beginnings for change may come from a sources-of-knowledge view of learning. Leo has a helpful way of illustrating three different processes implied in the term *conceptual understanding*. He calls these *conceptual development, conceptual resolution* and *conceptual exchange.*

INTRODUCTION

> 'Just after describing for me how liquid acetone evaporated if it is placed on your skin, a first year university chemistry student with good test results was unable to give me any examples of a liquefied gas. When pressed he muttered "Solids, liquids, gases" (a strangely immutable sequence that has neither evolutionary nor biblical support). Eventually, he said he thought the CO_2 in a cylinder was probably liquid. Gases could be liquefied by lowering the temperature, he said. On being asked to describe what would happen if he steadily cooled down the air in a space, he began by quoting, "Air molecules, tiny particles moving very rapidly with energy proportional to temperature." As he cooled them down in thought he held out his hands and slowed down the vibration of his fingers about a point in space. Finally, his fingers stopped and he said, "It's nothing." "What do you mean, has it disappeared?" I asked. "No," he replied, "but it's no longer a gas, and it's not a liquid or a solid. They are all just there suspended in space. It's nothing"!'
>
> (Fensham, 1983, 3)

- "The coating of the wire is an insulator. This coating keeps electrons within their pathway, preventing any loss of electricity"
- "The plastic coating on the wires has a resistance. Perhaps resistance could be reduced by devising good outer coatings"
- "Conductors help electricity keep going"
- "Perhaps D.C. and A.C. have something to do with the way a battery is connected"
- "I think we have D.C. in houses"

(Answers by several science graduates interviewed about electricity, White and Gunstone, 1981)

How could these good university students develop such poor and mixed-up ideas about areas of content that they have studied extensively? More importantly, how can their lecturers go about developing and changing these ideas? These are the sorts of research questions being asked in a relatively new area of research, which might be called "in-depth investigation of students' conceptual understandings". Most of this research is in science content areas. Some of it is in higher education.

What perspectives characterise this research? One is a view of the learner as an active sense maker. This implies a distinction between private understanding and public knowledge. Learning involves a learner in constructing his or her own understanding of some part of the public knowledge. Learning is making one's own sense of public knowledge.

A second is the nature of the learning task. The interest is not in atomistic learning, that is, in the learning of some small component of public knowledge. The interest is in the learning of large bodies of structured public knowledge (like Newtonian physics, the kinetic molecular theory of gases, and the classification and origin of rocks). There does not seem to be a general term for this, but I think that when people use terms like "conceptualisations", "frameworks", "conceptual understanding", they are referring to situations where students are attempting to internalise, to make their own sense of, relatively large bodies of organised public knowledge. It is this type of learning that is the interest of this paper.

Some of the work in this area is descriptive — it describes in considerable detail just what learners know about a content area. Much of this work concerns misconceptions and the classification of major misconceptions. For example, Clement (1982) tested and interviewed first-year engineering students about the relation between force and motion. He extracted a number of characteristics which he grouped together and called the "motion implies a force" conception. These students believed that continuing motion, even at constant velocity, implies the presence of a force in the direction of motion that is greater than any opposing force. Changes in an object's speed are accounted for by the force "dying out" or "building up". Such beliefs existed in many students after successful completion of their university physics courses. Such "wrong" conceptions are referred to by some researchers as "alternative frameworks", and, for a whole range of content areas, common alternative frameworks have been identified. Some examples from higher education are: evolution (Brumby, 1981), gravity (Gunstone and White, 1981), acceleration and velocity (Viennot, 1979) and Einsteinian physics (Posner *et al*, 1982).

A very different descriptive approach is the use of network-type diagrams to describe the knowledge structure or "cognitive structure" of learners in a particular area. The interest here is in the inter-relatedness between ideas, their integration and differentiation, the depth or shallowness of particular ideas, and so on. Most of this work has been in secondary education although there are some examples in higher education.

This descriptive work opened up many new vistas — some methodological, some epistemological, some psychological (see Erickson, 1984, for a comprehensive review). In the following I will expand on just a small part of these: what does it mean to know?, how does what we already know influence subsequent learning?, what is involved in changing our minds? Answers to these questions are far from complete. Yet we know enough to spell out new implications for teaching. Some of them are explored below.

A SOURCES-OF-KNOWLEDGE VIEW OF LEARNING

I find it useful (following Vygotsky, 1962) to identify two sources of knowledge in the individual. There is the knowledge that a person acquires from interaction with the environment. We might call this intuitive knowledge, "gut" knowledge, naive knowledge. It is influenced by language, by culture, by other individuals and so on. Such knowledge is a person's own sense making of the environment observed, tempered and manipulated by interaction with parents, peers, television, and other influences. Its primary characteristic is that it constitutes the person's reality. It is something one believes. Another characteristic is that this type of knowledge is acquired in a rather haphazard fashion, over considerable time, and without any particular direction. We do not set out to learn the nature of the earth as a cosmic body, for example. We know that the earth is flat to our eyes, yet round from photographs from space. We know about satellites, the Shuttle and a whole gamut of other things. At any time in our lives we have a particular conception of the world which we believe, think of as reality, "know" is shared by our peers.

The other source of knowledge is formal instruction, discipline knowledge, school knowledge. It is someone else's interpretation of the world, someone else's reality. Its primary characteristic is authority. It is "correct"; it is what the book says; what the professor says. It is approved by other people who are usually older and more highly regarded than the student. Our learning of this knowledge is goal directed. That is, we set out to learn, usually through instruction, a particular body of knowledge. We are usually expected to learn it in a certain time period. We are usually expected to demonstrate, most often through examinations, what we have learnt about it.

My view of genuine conceptual learning is the integration of knowledge from these two sources. I find a vine metaphor useful in understanding this integration. Imagine two vines, representing these different sources of knowledge, the one originating from the learner's intuitive knowledge of the world (which I call the upward growing vine to emphasise its part in the growth of the learner), the other originating from formal instruction (which I call the downward growing vine to emphasise its imposition on the learner from above). Genuine conceptual learning involves the intertwining of these two vines. (Biologists will probably have some concerns with my "downward" growth but I prefer to take some biological licence in order to retain an important image.) The postulated vine metaphor emphasises that once integration occurs, the sources of particular parts of the intertwined vines are impossible to identify — indeed, at that point, the question of source may be irrelevant. At the point of integration (which is at the point of learning) however, the sources of knowledge are most important.

One can imagine different situations that arise, depending on the nature of the two vines. There are four extremes.

So, if the learners want to make genuine effort to make sense of this knowledge (as opposed to rote learning numerous isolated knowledge bits), they will need to concentrate on integrating and differentiating the symbolic knowledge.

a. Conflict situation

Both vines are well established but they are in conflict. In this situation the learner's reality, the ideas that one believes and to which one is committed are in conflict with the principles being presented, which carry with them the authority of the discipline and the endorsement of the university or college. Mature learning in this case involves tranferring one's commitments from one set of ideas to another. It demands the questioning of one's reality; the abandonment of ideas that have been established over a long period — ideas that one knows are still held by members of one's subculture.

b. Congruent situation

Both vines are well established but not in conflict. In this situation the student's reality can be integrated with the school knowledge without special problems. There is no reality shock, no need to abandon old commitments. There is simply an extension and an integration of one's reality into a bigger perspective. When the discipline knowledge is presented, it merely reinforces existing ideas, integrating them into a larger whole, extending one's understanding of the world.

c. Symbolic knowledge situation

This is the situation where there is hardly any upward (intuitive knowledge) vine to interact with the downward (discipline knowledge) vine. An example of this is the learning of much of first year organic chemistry. There is little in the learner's intuitive knowledge that is relevant to the learning of, for example, the substitution reactions of benzene and its derivatives. For the student, this is an attempt to acquire pure symbolic knowledge. Even laboratory classes do not provide many elements of reality. It is doubtful that many first year chemistry students have seen, felt or smelt benzene yet they spend considerable time studying its chemistry.

d. Uninstructed situation

This is the case where there is little or no formal school knowledge vine; where all of the learner's knowledge is based on intuitive learning. This is a fascinating area for study, and research cited by Hewson (1984) demonstrates the powerful influence of cultural metaphors in shaping concept acquisition.

Conceptual development

The above rather idealised typology can be used to address the issue of conceptual learning in higher education. Acquiring relatively large bodies of complex, inter-related knowledge of the kind that is so common in higher education settings probably always begins as a symbolic knowledge situation. Given the authority and the demands of higher education, novices are usually forced to begin by ignoring their own realities. So, if the learners want to make genuine effort to make sense of this knowledge (as opposed to rote learning numerous isolated knowledge bits), they will need to concentrate on integrating and differentiating the symbolic knowledge. There is already enough evidence available to show that many students do not even attempt sense making in such situations. There are probably two reasons for this: few students, especially beginning tertiary students, have developed strategies for assisting integration and differentiation; and rarely are they asked to perform tasks that require integration or differentiation. A set of strategies, the so-called *concept mapping* exercises seem to be useful both in encouraging and evaluating integration and differentiation (see, for example, Novak, 1981; Fensham, Garrard and West, 1981; Cronin, Dekkers and Dunn, 1982).

The functional image elicited by the vine metaphor of these procedures is that of increasing the intertwining and consolidation of the various branches in the downward

growing vine, here and there allowing a single runner to push ahead, maybe intertwining with a runner from a different branch, or forming the beginning of a new expanding growth. The general image is of gradual expansion and increasing intertwining. It might be useful to dub this process *conceptual development* .

Here we have substantial reality clash. The classic example is of an Aristotelian-like view of mechanics (which is a common intuitive framework) challenged by Newtonian physics, and the Newtonian view, when eventually accepted, challenged again by Einsteinian physics. The resolution of such conflicts is a painful process which is difficult to achieve.

Conceptual resolution

At the extremes of this developing vine there will occur interactions with the upward growing vine of the learner's real world knowledge. Sometimes these will be conflict situations; at other times congruent situations. The former does not constitute a major reality shock of the kind that might confront a flat earth believer who sees a round world from space, but rather a minor conflict which on its own does not have to be resolved. For example, the learner can bypass the conflict by deciding to have two meanings for a word like "work" — one for physics, and one for the world of experience. Or, of course, the learner can try to create a relationship between these two meanings, or try to see the physicist's reason for retaining the word "work" but redefining its meaning. For many learners this would both resolve the conflict and open up avenues for further integration of the two vines. It might be useful to dub this process *conceptual resolution* .

For conceptual resolution involving a conflict situation I consider Osborne and Gilbert's interview about instances technique (IAI), and Kelly repertory grids (Kelly, 1955; Pope and Keen, 1981), used as instructional tools to be potentially effective. For conceptual resolution involving a congruent situation, the use of advance organisers or Venn diagrams (Gunstone, 1980) seem to be appropriate.

Conceptual exchange

What happens when the conflict situation is major? When the conflict is not just between one branch of one vine and one branch of the other, but between whole vines? Here we have substantial reality clash. The classic example is of an Aristotelian-like view of mechanics (which is a common intuitive framework) challenged by Newtonian physics, and the Newtonian view, when eventually accepted, challenged by Einsteinian physics. The former has been extensively researched in higher education (e.g. Champagne, Gunstone and Klopfer, 1984) and the latter has been the content area of a series of investigations by Posner, Strike, Hewson and others (e.g. Posner, Strike, Hewson and Gertzog, 1982). The resolution of such conflicts is a painful process which is difficult to achieve (Champagne, Gunstone and Klopfer, 1984).

The term *conceptual exchange* has been used to describe this process, and seems to be an appropriate descriptor. The nature of conceptual exchange has been explored at a theoretical level by Strike and Posner (1984) although, as West and Pines (1983) pointed out, this theoretical description ignores important non-rational components of conceptual exchange. A number of researchers have developed teaching strategies to assist conceptual exchange. The strategies usually involve three phases — an awareness phase, a disequilibrium phase and a reformulation phase. Posner *et al* (1982) provide an illustrative example. They suggested that the awareness phase involves the students actively seeking to make sense of new learning within their existing frameworks and finding that unsatisfactory. They suggest that teachers should spend a substantial portion of their time diagnosing student thinking errors and identifying defensive moves that students use to resist conceptual change. The disequilibrium phase for Posner *et al* involves the use of anomalies introduced by the teacher which challenge existing frameworks. They state that during this phase the teacher needs to adopt an adversary role in the sense of a Socratic tutor. The reformulation phase involves the presentation of the experts' conceptualisation with emphasis on the resolution of anomalies.

Champagne, Gunstone and Klopfer (1984) report on a week-long exercise conducted to help a group of science graduate volunteers resolve some of their problems in basic mechanics. The following quotes give a feeling of the difficulty experienced by students in changing their minds and of the value of the exercise.

> "...during [the] group discussion I changed my mind about the forces operating on the falling bodies... Some people fight hard not to change preconceived ideas. (Student I)

> It feels strange to contradict oneself half an hour later. It's worth the lengthy time involved because I can have time to gradually understand the issue at point... [it's] as if we are trying to turn a blind eye to the truth. It's comforting to try to keep certain ideas forever even if there's a chance that they may be wrong. (Student Z)

> I'm shattered! Didn't realise how devastating it could be to have a deep-rooted belief proved wrong. Can I blame my physics teacher? It would be all right if some dummy didn't pose a question which could be used to support the opposite argument. Seriously though, very instructive. I don't know if I'm going to be able to last the distance. I'm mentally exhausted after each session and the effort to hold out when I'm wrong is very draining. Great fun so far even if I hate it at odd times. (Student C)

> Even though I had the correct idea today that acceleration is approximately constant, at first I could only say that the forces were different by using F = ma. After

The first implication for educators in such areas of higher education must be one of deep concern. Something is terribly wrong. Many students are passing exams and getting through the system with very superficial, and sometimes very wrong ideas of the major concepts of our disciplines.

having to think of 'arguments' for this, I could justify it from an observational point of view ... The open discussion and justification of ideas is a brilliant way toward understanding physics. Substituting numbers in formulas seems to be a poor alternative. (Student L)"

IMPLICATIONS

The first implication for educators in such areas of higher education must be one of deep concern. Something is terribly wrong. Many students are passing exams and getting through the system with very superficial, and sometimes very wrong ideas of the major concepts of our disciplines. The jug and glass model of teaching-learning (in which the lecturer "pours" the knowledge into the students) which seems to be the rationale of many current teaching practices is inadequate. There are, at least, three processes implied in the term conceptual understanding, which I have called here, conceptual development, conceptual resolution and conceptual exchange.

Conceptual development is very common in higher education, especially in the early years. Most of the knowledge is symbolic (for the student) with few, if any, referrents in the real world. Most students have no framework to help them make sense of this symbolic (read "meaningless") knowledge. External aids to structuring such knowledge are, therefore, most important. Research with concept maps is most promising — both as student study strategies and as feedback strategies. If I can use a chemical engineering analogy, I think the laboratory work has been done, and we need now to see some pilot study research to find how such strategies can be incorporated into present practices. I also make a strong plea for the use of some student assessment procedures that require integration and differentiation of knowledge. Multiple choice and short answer questions, with their concentration on atoms of knowledge encourage the learning of knowledge bits in isolation.

Conceptual resolution is probably less important in higher education than in lower levels and so I will not emphasise it here.

Is it the responsibility of university or college lecturers to ensure that they create conditions in which genuine learning can occur, or is their responsibility merely to be transmitters of discipline knowledge?

At several places in higher education students face the formidable task of conceptual exchange. Students are able to "Newtonise", to use that example, and so appear knowledgeable, even when they are Aristotelian. Indeed Posner *et al* (1982) found a tutor who was teaching special relativity at Cornell, who was still Newtonian in his beliefs.

It is not difficult to identify areas where conceptual exchange will be necessary for most students. In these areas, simply lecturing will not achieve conceptual exchange — and intensive exercises of the kind used by Posner *et al*, Gunstone and others show a great deal of promise.

To achieve proper conceptual learning using some of the techniques described will necessarily lead to a reduction in content transmitted. Many will reject them on this ground. Is it the responsibility of university or college lecturers to ensure that they create conditions in which genuine learning can occur, or is their responsibility merely to be transmitters of discipline knowledge? This issue has not been addressed here — indeed it might be a useful topic for a future newsletter — although it is clear that I adopt the former position. On pragmatic grounds alone, I would prefer the in-depth understanding of a number of key ideas and concepts within the discipline than shallow and incorrect understanding of a much larger number.

Leo West,
Monash University.

References

Brumby, M. (1981) The use of problem-solving in meaningful learning in biology. *Research in Science Education, 11,* 111-120.

Champagne, A.B., Gunstone, R.J. & Klopfer, L.E. (1984) Effecting change in cognitive structures amongst physics students in West, L.H.T. & Pines, A.L. (Eds). *Cognitive Structure and Conceptual Change.* New York: Academic Press. (In press).

Clement, J. (1982) Students' preconceptions in introductory mechanics. *American Journal of Physics, 50,* 66.

Cronin, P.J., Dekkers, J. & Dunn, J.G. (1981) A procedure for using and evaluating concept maps. *Research in Science Education, 12,* 17-24.

Erickson, G.L. (1984) Some issues on cognitive structure and conceptual change in science education: one perspective from North America. Paper presented at a symposium on Cognitive Structure and Conceptual Change. AERA Annual Meeting, New Orleans.

Fensham, P.J. (1983) A research base for new objectives of science teaching. *Science Education, 64,* 323-336.

Fensham, P.J., Garrard, J.E. & West, L.H.T. (1981) Use of cognitive mapping in teaching and learning strategies. *Research in Science Education, 11,* 121-129.

Gunstone, R.F. & White, R.T. (1981) Understanding of gravity. *Science Education, 65,* 291-299.

Hewson, M.G. (1984) The role of intellectual environment in the origins of conceptions: an explanatory study. In West, L.H.T. & Pines, A.L. *Cognitive Structure and Conceptual Change.* New York: Academic Press. (In press).

Kelly, G.A. The Psychology of Personal Construct. New York: Norton, 1955.

Novak, J.D. (1981) The use of concept mapping and Gowan's "V" mapping instructional strategies in Junior High School science. Research Report. Cornell University, Ithaca. New York, 1981.

Pope, M.L. & Keen, T.R. (1981) *Personal Construct Psychology and Education.* London: Academic Press.

Posner, G.J., Strike, K.A., Hewson, P.W. & Gertzog, W.A. (1982) Accommodation of a scientific conception: towards a theory of conceptual change. *Science Education, 66,* 211-227.

Strike, K.A. & Posner, G.J. (1984) A conceptual change view of learning and understanding. In West, L.H.T. & Pines, A.L. (Eds.). *Cognitive Structure and Conceptual Change.* New York: Academic Press. (In press)

Viennot, L. (1979) Spontaneous reasoning in elementary dynamics. *European Journal of Science Education, 1,* 205-211.

Vygotsky, L.S. *Thought and Language.* E. Hanfmann & G. Vakar. (Trans.) Cambridge, Mass: MIT Press, 1962.

West, L.H.T. & Pines, A.L. (1982) How rational is rationality? *Science Education, 67,* 37-39.

West, L.H.T., Fensham, P.J. & Garrard, J.E. (1984) Describing the cognitive structures of learners following instruction in chemistry. In West, L.H.T. & Pines, A.L. *Cognitive Structure and Conceptual Change.* New York: Academic Press. (In press)

White, R.T. & Gunstone, R.F. (1980) Converting memory protocols to scores on several dimensions. Proceedings of the Conference of the Australia Association for Research in Education. Sydney, November, 1980, 486-492.

Cognitive Preferences and Learning

Do different students prefer to use different ways of dealing with new information? Are some of these ways more appropriate than others? If they are, what does this mean for classroom teaching? In this article Pinchas Tamir provides some answers to these questions from his many years of research on student learning.

Educational research has two main aims: (i) to extend and improve the theoretical base of education, namely our ability to understand and explain phenomena and behaviours related to learning and instruction; and (ii) to provide information which can be used to improve educational practice. It has long been recognised that people differ from each other in how they perceive, think, solve problems, learn, relate to others, etc. These individual modes have been designated as cognitive styles. The best known example of cognitive style is probably that of field dependence/independence (Witkin *et al*, 1977). In this article we focus on a relatively new comer to the arena of educational research designated as cognitive preferences. By cognitive preferences we refer to the modes used by people in processing information presented to them. Heath (1964) who invented the construct of cognitive preferences as a potential outcome of studying science in different ways identified four modes as follows:

1 **Memorisation** or **Recall** (R): Acceptance of information without consideration of implications, applications or limitations.
2 **Principles** (P): Acceptance of information because it exemplifies or illuminates a fundamental principle, concept or relationship.
3 **Critical questioning** (Q): Questioning of information regarding its nature, completeness, generalisability or limitations.
4 **Application** (A): Referring to the usefulness and applicability of information in general, social or scientific context.

The abbreviations R, P, Q, A will be used to represent the corresponding modes.

Heath and his followers hypothesised that cognitive preferences are acquired as a result of life and learning experiences and, in turn, influence further learning and subsequent information processing orientation.

Measurement of cognitive preferences

The most commonly used method of assessing cognitive preference is a paper and pencil inventory as suggested by Heath (1964). This is referred to as Cognitive Preference Inventory (CPI). The items in CPI appear like 4 options multiple choice. Each item presents an introductory statement (the item) followed by four extension statements, each corresponding closely to one of the modes (R, P, Q, A) defined above. The examinee is told that all four alternatives are correct and is asked either to select the most appealing option, or to choose the most and least appealing, or to rank all four statements as to their level of appeal to him/her. In doing so the respondent is assumed to display his/her cognitive preference pattern (or orientation, or style). This pattern is represented by the relationship among the R, P, Q, A scores.

Following is a sample item:

The pressure of a gas is directly proportional to its absolute temperature.

A The statement as given above fails to consider effects of volume changes and changes of state.
B Charles' or Gay Lusac's Law.
C The statement implies a lower limit to temperature.
D This principle is related to the fact that over-heated automobile tyres may blow out.

In this item (R) is represented by option B, (P) by C, (Q) by A and (A) by D.

CPIs consisting of 30 to 40 items similar to the above have been shown to have both test-retest and internal consistency reliability.

In contrast with achievement tests which are designed to test what a person *can* do, tests of cognitive style, including cognitive preference inventories, attempt to find out what a person typically *does* do.

Features of cognitive preferences

Important features of cognitive styles are stability, pervasiveness and distinctness.

Stability over time: "In the normal course of events we can predict with some accuracy that a person who has a particular style one day will have the same style the next day, month, and perhaps even years later. This stability makes stylistic dimensions particularly useful in long range guidance and counselling." (Witkin *et al*, 1977, 16). Indeed, individual cognitive preference patterns were found to be stable over three years and over different tests (King, 1980). This, as observed by Witkin *et al* (1977, 16) "does not imply that they [cognitive styles] are unchangeable". As we shall see later the search for desirable changes in cognitive preference orientation is a major aim of research in this area.

Pervasiveness: While a number of studies have shown that cognitive preferences are pervasive across different disciplines (e.g. Tamir and Kempa, 1977; 1978; Williams, 1975), further studies suggest that cognitive preferences consist of three components:

In contrast with achievement tests which are designed to test what a person **can** *do, tests of cognitive style, including cognitive preference inventories, attempt to find out what a person typically* **does** *do.*

The interest was not in "whether a student can identify correct or incorrect information but rather in what that student is likely to do with information intellectually" (Heath, 1964).

a) a general characteristic of the individual person based on inherited tendencies as well as on life experiences.
b) a discipline dependent component (e.g. biology, physics, social science).
c) a specific subject matter component (e.g. human biology, plants, outdoor biology).

The relative weights of these three components vary for different individuals and for different groups (see, for example, Tamir and Lunetta, 1978).

Distinctness: Some individuals have very distinct, stable and consistent cognitive preference style, while others do not appear to have a recognisable style, namely they fail to display consistent preference for any of the R, P, Q, A modes (Jungwirth, 1978; Van den Berg *et al*, 1982). While this variation in distinctness is certainly important to consider as far as individuals are concerned, it does not appear to affect significantly results obtained with whole groups (e.g. comparisons between males and females). An important implication of the fact that many young students (ages 14 to 16) lack a distinct cognitive preference style is that there is plenty of room for helping youngsters develop their cognitive preference orientation in desired directions.

The internal structure of cognitive preferences

As early as 1973, Kempa and Dube discovered consistent patterns of inter-relationships among the four cognitive preference modes. Two distinctive dimensions have been identified. The first appears with R on one pole and Q on the opposite pole. A high Q-R score would represent a high level of intellectual curiosity and, hence, the scale has been designated as the "curiosity scale". A second, somewhat weaker bi-polar scale has P on one pole and A on the other pole. A high P-A score implies a strong orientation toward the theoretical, while a low P-A score implies orientation towards the applied and the practical. This scale has been designated as the "utility scale". Some researchers (e.g. McRobbie, 1982) have gone as far as using these two dimensions, rather than the R, P, Q, A modes as raw data. The independence of R-Q and P-A appears to be an important advantage.

Cognitive preference and curriculum

Originally cognitive preferences were invented for the purpose of assessing distinctive outcomes of the "new" science curricula in the 1960s. The interest was not in "whether a student can identify correct or incorrect information but rather in what that student is likely to do with information intellectually" (Heath, 1964). A review of about 15 studies conducted in Australia, Israel, U.S.A. and U.K. indicates that on the average students who had studied the "new" science for at least one year have, as hypothesised by Heath, a lower level of preference for R and higher levels of preference for P and Q. On the average there were no significant differences regarding A. However in one study which assessed the effect of an application oriented environmental program the students who had studied the new program were found to have significantly higher preference for A than their control group (Tamir, 1977). It may be concluded that studying a curriculum with particular orientation such as inquiry, principles or application is likely to modify the information processing orientation of students towards the direction emphasised by that curriculum. Since stability and consistency are important attributes of cognitive style, it is worth mentioning that in spite of the changes which occur as a result of studying different curricula, the relative preference of individual students within a group remains quite stable at least over a period of two to three years (King, 1980).

Cognitive preference and achievement

Regardless of the kind of curriculum studied or instructional approaches or the kind of test used, high achievers have on the average a higher preference for P and Q and a lower preference for R and A.

King (1980) reports that for some groups of students a high preference for Q is more strongly related to achievement while for others a high preference for P is more strongly related to achievement.

Why is it that achievement is positively related to a preference for P and Q on the one hand and negatively related to a preference for R on the other hand?

Ausubel (1976) argues that compared with "particularisers" who rely heavily on rote learning of facts, "generalisers" who are capable of organising information under subsuming concepts learn and retain information better. McRobbie (1982) found that students who possess a high preference for Q tend to display a higher proportion of conceptually oriented linking relationships in their cognitive structure. Biggs (1979) classified second year college students into two groups on the basis of their replies to a questionnaire: Those who rote learned by focusing on facts and details, and those who learned by trying to understand the meaning of the material. They were then instructed to read abstracts of research reports and answer questions about details of the experiment as well as about the purpose and meaning of the experiment. It was found that learning and learners that focused on the meaning, exhibited significantly higher quality of learning as measured by their achievement on the Structure of Observed Learning Outcome (SOLO) scale (Biggs and Collis, 1982). It may be concluded that as far as achievement is concerned nurturing of orientation towards fundamental principles and critical questioning seems to be a valuable aim.

It may be concluded that as far as achievement is concerned nurturing of orientation towards fundamental principles and critical questioning seems to be a valuable aim.

Interests and occupational orientation

Williams (1975) found that fashion, merchandising and dental technician students in the U.S.A. exhibited, relative to liberal arts and science majors, significantly higher levels of preference for A. Similarly, Tamir and Kempa (1977) found that physical science majors in

Canadian and Israeli universities had the highest preference for P and the lowest for A, while engineering majors in Canada and medical students in Israel had, relative to other groups, the lowest scores in P and the highest in A. In general university studies indicate that pure science majors have the highest preference for P and the lowest preference for A while student teachers and engineering students had the highest preference for A and the lowest preference for Q. Medical students had the lowest preference for R, a high preference for P and a medium preference for A.

It may be concluded that career choices are associated with cognitive preferences.

The role of cognitive preferences in learning

Until recently the question of how cognitive preferences affect information processing and learning has not received systematic attention. King (1980) provides data which suggest that cognitive preferences are involved in the reception and perception or the encoding stage. McRobbie (1982) differentiates between the curiosity dimension (Q-R) and the utility dimension (P-A). His findings seem to indicate that the (P-A) dimension is associated predominantly with the kind of knowledge attended by the learner, however the (Q-R) dimension appears to be associated mostly with the way students organise the learned material in their cognitive structure.

It may be concluded that career choices are associated with cognitive preferences.

What are the implications of all these?

Cognitive preferences appear to be a viable and significant attribute of learners. In this sense cognitive preferences constitute an aptitude as defined by Cronbach and Snow (1977).

There are three alternatives for dealing with aptitude treatment interactions in educational practice:

a) adapting the instructional characteristics to the aptitude of the learner;
b) providing a variety of learning experiences so that learners can find some experiences which fit their aptitudes;
c) modifying the aptitude to make a more effective and better learner.

Some aptitudes, such as the style of field dependence, are so stable that the probability of changing them is practically nil. However, as shown above, cognitive preferences can be changed by curriculum and instruction.

Alternative (a) is not recommended for the following reasons:

1 It is very difficult to individualise instruction under normal classroom conditions.
2 A preference for R is undesirable both in itself and for its negative effect on the quality of learning.
3 Attempts to adapt instructional treatment to the cognitive preferences of learners have failed to improve achievement (McRobbie, 1982).

Alternative (b) is always desirable: a variety of learning experiences not only provides experiences which match different aptitudes but makes learning richer and more interesting. The major conclusion of research on cognitive preferences appears to be the feasibility and desirability of alternative (c). It is my belief that courses at all levels of education should be taught with the aim of reducing the orientation towards rote learning (a preference for R) and promoting the preference for the other three modes, namely principles, ciritical questioning and application. Orientation towards P, A and Q, is associated with a higher quality of learning as well as with higher achievement.

Pinchas Tamir,
Hebrew University, Jerusalem.

Courses at all levels of education should be taught with the aim of reducing the orientation towards rote learning.

References

Ausubel, D.P. (1976). The facilitation of meaningful verbal learning in the classroom. Paper presented at the annual meeting of the American Psychological Association.

Biggs, J.B. (1979). Individual differences in study processes and the quality of learning outcomes. *Higher Education, 8,* 381-394.

Biggs, J.B. & Collis, K.F. (1982). *Evaluating the quality of learning.* New York, Academic Press.

Cronbach, L.Y. & Snow, R.E. (1977). *Aptitudes and instructional methods: a handbook of research on interactions.* New York, Irvington.

Heath, R.W. (1964). Curriculum cognition and educational measurement. *Educational and Psychological Measurement, 24,* 239-253.

Jungwirth, E. (1978). Cognitive consistency in cognitive preference tests and its implications for test validity. *Studies in Educational Evaluation, 4,* 121-122.

Kempa, R.F. & Dube, G.E. (1973). Cognitive preference orientations in students of chemistry. *British Journal of Educational Psychology, 43,* 279-288.

King, J.N. (1980). Modes of information perception and transformation in science students. Unpublished Ph.D. dissertation, The University of Keele.

McRobbie, C.J. (1982). Cognitive preferences and chemistry learning, Unpublished Ph.D. dissertation, Monash University, Victoria.

Tamir, P. (1979) Cognitive preferences in agriculture of middle school students and their teachers. *European Journal of Science Education, 1,* 327-338.

Tamir, P. (1984) A meta-analysis of cognitive preferences. *Journal of Research in Science Teaching,* in press.

Tamir, P. & Kempa, R.F. (1977). College students; cognitive preferences in science. *Journal of Educational Research, 71,* 86-92.

Tamir, P. & Kempa, R.F. (1978). Cognitive preference styles across three science disciplines. *Science Education, 62,* 143-152.

Tamir, P. & Lunetta, V.N. (1978) Cognitive preferences in biology of a group of talented high school students. *Journal of Research in Science Teaching, 15,* 59-64.

Van der Berg, E., Lunetta, V.N. & Tamir, P. (1982) Cognitive preferences: a validation study. *Journal of Research in Science Teaching, 19,* 417-424.

Williams, C. (1975) A study of cognitive preferences. *Journal of Experimental Education, 43,* 61-77.

Within, H.A., Moore, C.A., Goodenough, D.R. & Cox, P.W. (1977) Field dependent and field independent cognitive styles and their educational implications, *Review of Educational Research, 47,* 1-64.

TELECONFERENCING

In Australia, the large distances between population centres have an inhibiting effect on the operation of organisations at a national level. For example, face to face meetings of executives from even two capital cities involves considerable travel time and cost. Teleconferencing can provide a very economical and effective alternative for such meetings. Michael Parer provides an overview of teleconferencing and reports on its use in planning the HERDSA educational developers seminar.

We all use the telephone daily. We take it as an extension of our personal interaction with colleagues and clients. We use it to conduct business, arrange meetings and counsel students.

Much of our professional work is carried on in small groups as we discuss research, collaborate in development projects and hold executive meetings.

While we extend our one-to-one business to the telephone without a second thought, many rarely extend the group activity to the telephone. Yet teleconferencing has been available for many years. Some use it extensively, but most not at all. I would fall into the former category and link in readily to colleagues for planning and research discussions, and to students for off-campus tutorials. On every occasion I have found it efficient, productive and cost effective.

There are several variations as to what is meant by teleconferencing. Firstly, it is the linking through the Telecom switch of more than two telephones simultaneously. Theoretically any number of telephones can be linked at one time, but in practice a maximum of six is recommended. The cost is calculated as the sum of the local or STD charges from the central location to each of the telephones plus two small connecting fees. Thus the linking from Churchill in Eastern Victoria to Brisbane, Sydney, Melbourne and Adelaide would be the sum of the STD charges from Churchill to each of these cities plus a $1.00 fee for each connection and a single $1.20 conference call fee.

The Telecom description of the nature of this service is given in their operators manual.

4.21.1 **Nature of Service.** By using conference call facilities, a number of telephone services may be connected together for a simultaneous telephone call. These calls may include any combination of local, trunk and international calls. They may also include several customers located in the same local call area. The total number of parties who can be connected is determined by the capacity of the conference equipment. Conference facilities are available at capital cities and some other centres and may also be used for calls from any other exchange if the necessary trunk circuits are available at the time the call is required. The particular person and fixed time services are available on conference calls. Reverse charge service is not available on conference calls.

Telecom Australia have a booklet on Audio Teleconferencing that they presented at the Satellite Users Conference in March 1983.

When a central location is linked to a number of individual telephones in a single STD area, then the charge is one distance call plus the Telecom connecting fees. Thus teletutorials with students are best organised within geographical STD areas.

Secondly, teleconferencing can mean a central location with a loud-speaking telephone into which a number of individuals may speak, and the linking to more than one other telephone, either with or without loudspeakers. A number of reports are available on projects that have been undertaken in an educational setting (Broadley, K. and Shaw, B. 1982; Collins, J. 1978; Cavanagh, T. 1982; Meggitt, P. 1981; 1983; Vernon, C. 1983).

And thirdly, teleconferencing can be the connection of one station with a loud-speaking telephone to another with a loud-speaking telephone. This is the usual method for Teletutorials at study centres.

Some have experienced drop-out or fading when a number of telephones are linked together. For myself, this has rarely been a problem, but Telecom have developed through their research branch a bridging station that avoids this drop-out and also enables a central station to hook up many telephones without going through the central Telecom office. This was trialled in an educational project in the Charlton area of North Eastern Victoria in 1982 and is soon to come on the market (Conby, I. 1983).

At the 1983 HERDSA General Meeting it was resolved to organise an educational developers seminar and a sub-committee was formed of Ingrid Moses (University of Queensland), David Boud (University of New South Wales), Helen Edwards (Lincoln Institute, Melbourne, Victoria), Alan Lonsdale (Western Australian Institute of Technology), and myself at Gippsland institute of Advanced Education. The seminar was to be a new event and it was felt that detailed planning would enhance its success. I proposed that we meet by teleconference on a monthly basis for planning. Two queries emerged. Firstly, the sub-committee members were unfamiliar and inexperienced in using teleconferencing and secondly, there was the question of cost. The first query was overcome by the willingness of the sub-committee members to try teleconferencing and the second by a research and development grant of $500 from the Gippsland Institute.

Five teleconferences were held of 43, 45, 30, 40 and 40 minutes at a cost of $98.45, $115.60, $42.80, $37.90 and $60.20 respectively. The considerable variation in charges is explained by the fact that not all committee members were on-line for every teleconference; indeed, it was only the second one that was attended by all. The cheapest call was attended by two of the GIAE loud-speaking phone and two committee members at the University of New South Wales.

Thus five planning committees were held for a total time of 3 hours 18 minutes and a cost of $354.95.

Preliminary dates and times were arranged by my secretary through correspondence and the Telecom connections were booked through the GIAE switchboard an hour prior to the scheduled time. David Boud had corresponded with committee members to get their input and arrange an agenda. On each occasion Telecom connected each of the stations at precisely the appointed time and without any hitch. I spoke to each member in

turn and then handed the meeting over to David Boud. I suggested that we do not have a structure for our discussion, but if confusion did arise I would intervene with some formal ground rules. This never became necessary. I noted that the anticipated duration would be about 45 minutes, and after 30 minutes indicated the duration to that point. The meeting proceeded in an orderly fashion with efficient and focused discussion, with each participant feeling free to intervene or at times interrupt and indicate they had some contribution to make when the current speaker had finished. The first meeting concluded in 43 minutes with all business completed and the next meeting arranged. There was feeling of success and of time well spent without any of us leaving our office. There was no experience of drop-out on any line. Ingrid Moses of the University of Queensland was not available for that first conference and so a recorded audio cassette of the teleconference was sent to her.

It was planned to have a further conference after the seminar to discuss its results. However, this was scheduled in the week of the Christmas break-up parties and proved a little too difficult to schedule.

Today talk of new communication technologies is dominated by micro-computers and satellites. It is easy to overlook the Bell technology on our desktop and fail to maximise its use. When the cost of teleconferences is compared to the cost and travel time to attend meetings, its value can be genuinely appreciated.

A couple of examples may illustrate. Recently I linked for a discussion on nurse education with Melbourne and Bendigo from Churchill. Previously we met at Bendigo involving an overnight trip. By teleconferencing, our business was completed in 40 minutes. The second occasion was linking from GIAE with a research colleague in my office at our loud-speaking phone to the James Cook University research group to discuss student study methods research projects. The $40.00 phone call was in place of a single $415 round air trip for my colleague.

Research has shown that teleconferencing is not productive when it is a first meeting between strangers, who have not met in conference previously. Teleconferencing is good for business, research and planning agendas but not always good for personal counselling and issues that are sensitive to the demands of human relationships.

There is an upper limit of participants for an efficient teleconference and it may be argued that involving a large group, for example the HERDSA Executive of 19 members, would defy a productive teleconference. However, members in each geographical area could meet in clusters and the meeting could be conducted over several hours with several, say 20 minute, teleconference hook-ups at intervals during that period.

The ASPESA Executive with members from Darwin to Fiji, New Zealand to Perth, regularly meet by teleconference and recently tried a mixture of telephone and satellite. This has problems of drop-out and one-way communication on the satellite system, but it provides a regular link between executive members that otherwise would be impossible.

Teleconferencing is a method of meeting that has been slow to develop but offers considerable advantages for national organisations in a country as vast as Australia.

Michael Parer,
Gippsland I.A.E.

References

Broadley, C. & Shaw, B. (1982). *Tutoring by telephone — a trial in teaching extramural students in 36.102 Human Development 1982.* Department of Education, Massey University, Palmerston North, December 1982.

Cavanagh, T. (1982). *Telephone tutorials — a learning experience.* Australian and South Pacific External Studies Association Newsletter, Churchill, 8, *1*, 7.

Collins, J. *The teletutorial project — a report to January 1978.* Council for Adult Education, Melbourne, Telecom Australia Audio Conferencing SAT Users Conference, Melbourne, March 1983.

Conby, I. (1983). *Educational Technology Unit, Two-way radio in schools,* or, *The loneliness of the long distance learner — An evaluation of high-frequency short-wave two-way radio trials.* Report prepared for the Victorian County Education Project, Melbourne, October 1983.

Meggitt, P. (1981). *Telephone tutorials — a cost benefit analysis.* Australian and South Pacific External Studies Association Newsletter, Churchill. *7, 1.*

Meggitt, P. (1983). *Telephone tutoring in Australia — Case Study No. 7.* In Administration of Distance Teaching Institutions, Case Studies, International Extension College, London.

Vernon, C. (1982). *Implementation and evaluation of a telephone support program promoting student survival.* Gippsland Institute of Advanced Education document, Churchill.

The 1985 National Conference on
THE FRESHMAN YEAR EXPERIENCE

"Retaining and Educating Freshmen in the Information Age"

This conference, to be held from February 17th — 20th 1985 in Colombia, South Carolina U.S.A., is the fourth in a series organised by the University of South Carolina's University 101 program. The goal of the conferences is "to assist institutions of higher education in the planning, implementing, and refining of programs designed to enhance the freshman year experience". For the 1985 conference the categories and illustrative topics to be addressed are: freshman seminar courses, programs for specific populations, the freshman as an individual, the freshman in the information age, research, freshman curricula, student development programs, academic advisement programs, special administrative units for freshmen.

The organisers are particularly desirous of having proposals submitted by Australasian educators, and to this end have extended the deadline for Australian educators to January 1, 1985. Any member wishing a copy of the conference brochure, proposal form, etc may obtain these by writing or phoning HERDSA C/- TERC, The University of N.S.W., P.O. Box 1, Kensington 2033 NSW; phone (02) 697-4937.

REVIEWS

Professional Education, Peter Jarvis, London, Croom Helm, 1983. 150 pp. ISBN 0-7099-1409. $23.50.

Peter Jarvis's intention appears to be to establish an overall set of principles upon which professional education of any sort could be based, and to do this in such a way that practitioners might take those principles and (without too much extra work) apply them to their particular circumstances. I do not think he has entirely succeeded in doing all this, but I am convinced his attempt is well worth reading — by practitioners as well as educational theorists.

He has managed, with enviable skill, to survey extensive tracts of philosophical territory as well as quite a lot of sociology and psychology. Which brings me to the first of the bad news; not everyone will be happy with how Jarvis handles this interdisciplinary task. It does read, far too often I fear, rather like the sketch for a doctoral thesis. We find Peters, Illich, Hirst, Friere, Dewey, Popper, Merton, Gagne, Knowles, Musgrave, Uncle Tom Cobbly and all tossed together in a pot. What comes out of the brew? Jarvis's prescription for professional education, derived from a very simple (too simple?) argument:

If education consists of X
and professionalism consists of Y
then professional education consists of X + Y
and anything you care to say about professional education should be consistent with the separate characters of X and Y.

Non-philosophical readers can skip the early chapters if they wish, as Jarvis regularly repeats his main position on each issue in subsequent chapters where the aims, content and methods of professional education are taken up. But let the reader beware: Jarvis is a theorist at heart, and tantalisingly non-committal about exactly what he would do in practice.

There is some shallowness (such as the way indoctrination is treated); some obscurity (an odd, unexplained fear of lecturing); some narrowness of outlook (even his view of what teaching comprises is oddly restricted); and some strange omissions (no reference to Schein, for instance). On top of this the reader becomes impatient with too much hopping about from short courses to four-year degrees, instead of stopping to work out the theory's implications for any particular level or type of professional education.

The text is well proofed, but in the bibliography I spotted at least three wrong titles and one wrong date and there is a distracting policy of using quotation marks instead of italics or underlining for titles.

On the credit side, however, I like the way Jarvis tackles the ethical dimension of every issue he meets within his argument. His style of regular recapitulation and summary may annoy some but is vastly preferable to more pretentious alternatives which attribute photographic memory to the reader. And the sometimes startling interdisciplinarity is, to say the least, stimulating; I would like to believe it is an indispensable element of any proper discussion of professional education.

I found the most practically useful sections to be that which deals with competency (an important concept later applied to the training of professional educators) and the chapter on selection of curriculum content for professional education. Other readers will find much else to interest them in what is a very wide-ranging book. I know of no other volume, of whatever size, attempting to analyse in a rational fashion this complex topic. Jarvis's insights, though not the final word on it, do deserve to be examined, shared, criticised and tried out by a wide audience in higher and continuing education.

Lee Andresen,
University of New South Wales.

Research Student and Supervisor: An Approach to Good Supervisory Practice, Science and Engineering Research Council, Polaris House, North Star Avenue, Swindon SN21ET UK, SERC, 1983, free.

This free booklet by the Science and Engineering Research Council (SERC) is a document produced by a team of seven British academics. Research Councils in Britain recognised in 1980 that the completion record of students receiving grants was "far from satisfactory". The results of a survey published in the Spring 1981 SERC Bulletin revealed that less than half of the Ph.D. students completed their theses within the three years, considered by the majority of British academics as the normal period for a Ph.D. The purpose of this document is to make both students and supervisors more aware of the problems and to suggest procedures to ensure that students complete their Ph.D.s on time. The authors argue that there is a need for students to submit their theses within three years of full-time study, because almost all work activities in real life must be carried out within a certain time scale, and because students are accountable for the funds or free education they are receiving. There are mainly two aspects of supervision:

1. to select problems/topics for students and to provide professional guidance;
2. to ensure that students make good progress.

This booklet only deals with the second aspect and suggests that there are four main reasons why students do not complete their theses on time:

1. A slow start, e.g. with the formulation of the problem and with the literature survey.
2. Perfectionism of students who are never satisfied with their work.
3. Distraction from the main line of enquiry, e.g. by computing or reading texts unrelated to the topic.
4. Inadequate collation of data due to a lack of planning, e.g. in note-taking, referencing, etc.

A useful "Check List on Good Supervisory Practice" (in the form of questions) brings out the main suggestions for supervisors' procedures to ensure that their students make good progress, e.g.:

- Departmental document on good supervisory practice.
- Matching supervisor and prospective students.
- A reading guide for the summer vacation.
- The student's first-year report to be assessed by people other than the supervisor.
- Regular meetings between student and supervisor.

- Checking the student's systematic record keeping.
- Mock viva: six to twelve months before the submission of the thesis.

These general guidelines would need to be specified in actual practice in order to be useful to supervisors and to have an effect on students' progress. However, this is a first, laudable step towards improving postgraduate supervision, a step which should be taken up and worked out in more detail by practitioners.

Throughout the document individual supervision is implied; workshops and small-group activities are not mentioned, but are not excluded either. For example, there are certain skills which could be developed more effectively in group discussions, such as defining a research proposal, dissertation design and rationale, critical analysis of texts, analysis of contradicting sources, note-taking, referencing and other "nuts and bolts" of dissertation research and writing.

Ortrun Zuber-Skerritt,
Griffith University.

Informatics Education For All Students At University Level, edited by F.B. Louis and E.D. Tagg, Elsevier Science Publishers (North-Holland), 1983.

Informatics was a new term to me and my enquiries failed to turn up a succinct definition of the word. Literature searches, however, revealed other publications of similar title and my reading of these indicated that the term appears to be a European expression for what is generally understood to be Information Processing.

The book contained 24 papers of the 31 invited participants from 12 countries who constituted the first Working Conference of the International Federation of Information Processing (IFIP): Working Party on Advanced Curriculum Projects. This conference was held in Holland during 1983 and the speakers were invited to outline the work in their own universities and to make comment on the immediate future needs of this field.

The papers are grouped in the book under various discipline headings and several of the papers appeared to be incorrectly grouped. However, for the sake of convenience, I will conform to the designated groups for the following discussion.

The keynote address "Computers in Education — The Next Step" presented an excellent resumé of the role of CAI at tertiary level and listed guidelines for future development. Unfortunately the standard of this paper was not maintained throughout the remainder of the book, nor was the theme of CAI continued in any great depth.

The section on Social Sciences and Humanities contained papers from Japan and Canada. The Canadian paper related the experience at the University of Waterloo and gave a coverage of such issues as CAI, media networking, student ownership of micros and touched on the social issues related to computing. The benefits of word processing and data bases were also mentioned.

One paper in the Medical Group discussed briefly security aspects of computer based medical records, another the role of computer assisted diagnosis. The third paper, incorrectly located under medicine raised the issue of the relationship between electronics and software and stressed, albeit briefly, the importance and potential use of "the connectors on the rear panel" of a microcomputer.

The most valuable contribution on Business Studies related to an experience at the University of Geneva where spread sheets have been used as the means of teaching the principles of interactive computing. This approach avoids the need to teach a programming language but still permits exposure to a wide range of computing protocols. The final paper in this section is a rather comprehensive paper on engineering and stressed the modification of the traditional role of Engineers in order to cope with developments of CAD/CAM. The four papers correctly filed under engineering continued this same theme.

The section on Econometrics and Law commenced with a good coverage on the need to train the potential lawyer in computer appreciation and ended with another giving a detailed outline of a course on computer literacy for teachers.

The book concluded with a section on Mathematics, Science and Engineering. The final paper on the Conference Theme, "Informatics for Everyone", is the most perceptive paper in the book. It looked at a teaching strategy for the next 10 years covering the range, pre-school to university. The need to balance computer skills with checking procedures via approximate analysis and intuition is raised. This paper reinforces some issues raised in the keynote address.

The general tone of the papers gave an impression of a casual after-dinner fireside conversation between the invited participants. Accordingly it makes interesting fireside reading, offering a little bit for everyone but nothing of any great substance for in-depth reference.

The book will be of greatest value to those academics working in non-computer based disciplines who are considering the need to introduce units on computer awareness into their couses. However in the foreword to the book it is noted that the conference did not reach a consensus on how to teach informatics so the reader will still be left to resolve both the "how" and the "what" of many curriculum design problems.

G.W. Smith,
Chisholm Institute of Technology.

Teaching and Learning Languages, Earl W. Stevick, Cambridge: Cambridge University Press, 1982, 215 pp.

How do you teach English as a Second Language?

The question itself seems naive, but Stevick's book would seem to be providing an answer in a most basic and comprehensive form. The general impression is that it is aimed at an audience which is non-initiated into the world of E.S.L.; the problem is that one wonders who this audience is, and whether after reading Stevick's book they will be let loose in a classroom of students of English.

Chapters of the book covering such aspects as the use of the tape recorder in the foreign language classroom are very practical, but because the book is so comprehensive, the information on each particular area suffers from lack of depth. However, he does list some very useful techniques in areas such as drilling, games, ways to oral activity and explains the theoretical bases of these; the difference

between acquisition and learning, what is meant by "communicative competence".

The section on pronunciation is particularly sketchy. Here, the concepts of stress and pitch are introduced, but Stevick does not mention the use of phonetic correction, and skirts around the all-important subjects of appropriacy and register.

If this book is aimed at an audience of non-initiates, the author would have done well to mention diverse methodologies which abound in this field, in order to warn the unwary about "evangelism" in E.S.P. (Alan Maley's term). To give him his due, the reference list for further reading is thoroughly comprehensive and this makes the reader feel that this particular book should actually be used as a point of departure. Taken in this way, *Teaching and Learning Languages* could be considered as an interesting and generally informative work, a kind of basic encyclopedia of E.S.L./E.F.L.

There is one generalisation made with which I would like to take issue. He states that "wherever you go the basic meaning of a smile is pleasure". While I see his point, it may be more than mere pedantry to point out that in some cultures a smile can mean anything from embarrassment through pleasure, to respect.

Barbara Lasserre,
University of New South Wales.

Conference Report

THE FUTURE OF HIGHER EDUCATION
A report on the 1983 Annual Conference of the Society for Research into Higher Education

About two hundred delegates participated in the last annual conference of the SRHE which took place at Loughborough University of Technology, 14-16 December, 1983.

The SRHE Staff Development Group met one day prior to the conference to hold their annual general meeting, a symposium and workshops on Staff Development. Professor Lewis Elton gave an excellent paper on "The Leverhulme Study and Academic Staff Development".

As one might have expected, the arguments and recommendations coming from the SRHE Staff Development Group as well as from speakers at the main conference, very much resembled the discussions in Australia after the Williams Report, the AVCC Report on Staff Development and the HERDSA Policy on Staff Development.

Apart from these similarities — mainly in the field of professional development and summative evaluation of teaching — one could also detect differences in some areas of concern in higher education in Britain as compared to those in Australia.

While both countries are concerned with the problem of "autonomy and accountability" or "freedom and control", one of the future trends in Britain seems to be reform in the structure of courses in order to meet the job needs of a rapidly changing society and the needs of a demographically changing student population. For example, the present three-year pass degree or four-year honours course is proposed to be replaced by a two-year degree course with subsequent optional part-time or external specialist courses. Derek Bosworth (Department of Economics, Loughborough University of Technology) in his paper on "Course length and content" tried to prove by empirical evidence that the best for the student, from a financial viewpoint, is a two-year core course of "mainstream" subjects, and later on — depending on the individual's evolving career plans — additional, "bolt-on" courses; either academic courses for those planning to go into academia or non-science technology courses for those moving into management. The learning-teaching methods would also change, i.e., in the direction of part-time, distance learning methods based on the new advanced information technologies. Bosworth concluded that a two-year core-course and additional, vocationally oriented courses would bring higher rates of return to the individual than the present three- or four-year degree courses

This paper was received with great interest and followed by a lively discussion not the least because it so aptly supported the SRHE/Leverhulme policy document *Excellence in Diversity* (1983). However, there were objections and reservations, too. A good example might be Pat Cryer's comment that income and financial reward are not the only incentives for study in higher education; that there are other motives, such as status and intrinsic motivation.

Another area of concern was the relationship between research and good undergraduate teaching, and a comparison between the quality of students from universities and from polytechnics. Maurice Kogan (Brunel University) reported on his provisional findings of a policy-related project funded by the Department of Education and Science. He analysed the expectations of higher education held by employers, students, providers, and career advisers in higher education institutions. While he stated and implied that most employers prefer graduates from universities to those from polytechnics and that many students at polytechnics would have preferred to enter university, Paul Ramsden (Newastle-upon-Tyne Polytechnics) found that "Students' Experiences in Universities and Polytechnics" do not justify these views. On the contrary, the polytechnic students are more likely to use "deep approaches" to studying (i.e., they try to understand what they are learning) and they experience better teaching and more clearly structured course programmes than their university counterparts. Although university students have higher entry qualifications, both groups of students report similar patterns of study organisation, but polytechnic students are more interested in their courses because they consider them to be more vocationally relevant.

Ramsden concluded that employers' understanding and assessment of polytechnics are wrong; that there is a correlation between good teaching and students' "deep meaning-orientation" to study; but that there is no strong correlation between research and high undergraduate learning.

John Maddox (editor of *Nature*) agreed that staff need not be deeply involved in research in order to be good undergraduate teachers, but that research, e.g., in Science and Engineering, is essential for postgraduate teaching, and for stimulation/excitement on the part of the researcher. His pleading for a greater diversity in higher education institutions seems to be the answer to the dispute on whether there is a relationship between research and good undergraduate teaching. He claims

that some institutions should be allowed to go into industrial research (like MIT, and Aachen University of Technology), others into other directions (e.g., academic, educational vocational, economic).

Guy Neave (European Institute of Education and Social Policy, Brussels) likewise, saw contract research as the new trend in Western European higher education. He explained the increasing para-academic research activities outside the universities with the fact that young academics who do not find jobs, but have the research capacity, are employed by industry.

On the whole, this conference was informative and stimulating. Most papers were of high quality. Of particular interest to HERDSA members might be the following contributions in the forthcoming proceedings: *The Future of Higher Education*.

- "The *Leverhulme* Perspective" by Gareth Williams, University of Lancaster and Chairman of the Leverhulme project.
- The Symposium concerning international perspectives, especially the paper on themes and future trends in higher education in the USA (on access, content and quality control) by Ernest Boyer, President of the Carnegie Foundation for the Advancement of Teaching.
- Concluding thoughts and reflections from a panel of guest speakers: Donald Bligh (University of Exeter), Peter Scott (Editor of *The Times Higher Education Supplement*), Michael Shattock (Registrar, University of Warwick), and Peter Knight (Deputy Director, Preston Polytechnic).
- (and for entertainment): "What were universities for?" (A satirical essay on the fight for survival of higher education in the 1980s seen from the perspective of the 1990s) by John Darling (University of Aberdeen).

Ortrun Zuber-Skerritt,
Griffith University.

ABSTRACTS

HERDSA Abstracts are based on a regular survey of relevant literature. They are intended for use by tertiary teachers, research workers, students, administrators and librarians. The abstracts are classified into the same groups used by the Society for Research into Higher Education in their quarterly publication *Research into higher education abstracts*.

The *Abstracts* attempt a coverage of current English language publications in Australia, New Zealand, Papua New Guinea and Indonesia. Publications describing research, teaching, administration, staff and students in higher education are abstracted.

Educational or other non-profit organisations may reproduce a limited number of these abstracts in their own publications provided that HERDSA receives suitable acknowledgment.

HERDSA is most grateful to its abstractors and the co-operation of the editors of a number of journals abstracted in this issue. The *Abstracts* are edited by Robert Cannon, Director, Advisory Centre for University Education, The University of Adelaide, Adelaide, S.A. 5000.

Note: Authors or editors who would like abstracts of articles, books or monographs to be included are invited to send a copy of their work, together with an abstract, to the *Abstracts* editor.

A GENERAL

Hore, T., and West, L.H.T. **The future of higher education in Australia: ten years on.** Higher Education Research and Development, 3, 1, 1984: 51-59.

During 1975 a group of Monash University academics, who became nicknamed the "crystal ballgazers" began to meet with the aim of forecasting the future of higher education in Australia in the nineteen eighties and nineties. The predictions were published and by 1983 many of the forecasts had already proved remarkably accurate — and few, if any, of the pro-active strategies that were suggested as a way of influencing the future had been adopted.

This paper provides two retrospective analyses of that work. In the first we present some of the actual forecasts and their accord with reality, and then juxtapose the reasons for our forecasts upon the reasons being proposed now for the trends that have emerged. In the second analysis, we examine the failure of the work to influence the power brokers in Australian higher education to adopt a longer term and a more pro-active planning role.

(Journal abstract)

Karmel, P. **Education and training for work and living.** The Australian Journal of Education, 28, 2, August 1984: 190-201.

The weak position of teenagers in the labour market, the shift to service industries employing white rather than blue collar workers, the need for highly qualified workers, and the fight to improve the position of the disadvantaged make an increase in participation in post-compulsory secondary and tertiary education desirable. Increased participation in the senior years of high school should aim to give students opportunities to participate in the mainstream of economic and social activity. Revamped curricula should be seen as vehicles for achieving competency in communication — reading, writing, speaking, calculating, computing. They should involve intellectual effort and the acquisition of communication skills. The present apprenticeship system should be allowed to run down and be replaced by a comprehensive training scheme. In such a scheme, young people should be trainees and not employees. All employers should provide a proportion of places within their work-force for trainees. If more educational and training services are to be offered, it is important that all such services be offered in cost-effective ways. The continual pressure for resources to reduce class size and contact hours will place in jeopardy plans for widening educational opportunities. Top priorities should be for more resources to raise educational participation in post-compulsory schooling and tertiary education and to establish a rational training system, and for such reallocation of existing resources as is necessary to raise the minimum competencies to be achieved during compulsory schooling. Until these have been achieved, demands for richer provisions per teacher or per pupil should be postponed.

(Journal abstract)

White, M. **Distance education in Australian higher education — a history.** Distance Education, 3, 2, 1982: 255-278.

Distance education, usually described in Australia as "external studies" has a long history in Australian universities, although the situation since about 1965 has been marked by very considerable new development in all tertiary institutions. No longer is external study the very courageous innovation it was when the University of Queensland established a Department of Correspondence Studies in 1911; indeed it has become a very significant feature of Australian higher education generally. Reasons behind the introduction and expansion of external study extend beyond simply meeting the needs of people in rural areas, though these were important in the early stages. This article considers the wider policy issues affecting developments in Australian states, while also drawing attention to previously undocumented proposals in the nineteen thirties that established a base from which post-World War II policy has been derived.

(Journal abstract)

B SYSTEMS AND INSTITUTIONS

Gillard, G., Kemmis, S., and Bartlett, L. **Collaboration between two universities in course development.** Higher Education Research and Development, 3, 1, 1984: 71-79.

In 1981 it looked as though there could be collaboration between Deakin University and the University of Queensland in the co-development of courses leading to a Master of Education degree to be offered externally and by course work. It was hoped that there would be joint development of three courses — about half of the minimal degree program. In the event, only one of the three courses was produced by intensive co-development. The present study is an investigation of factors involved in the collaboration, and consequently of issues involved in any such enterprise. It is concluded that a collaborative venture is likely to succeed if it is based on a collegiate network, or on a good working relationship between academics who share research and teaching interests. It is also suggested that such collaboration can best be fostered by establishing a climate within and between institutions in which particular collaborative initiatives can be initiated and sustained. Finally, it is suggested that collaborative co-development and co-production and parellel provision of course may offer a way out of the dilemma of collaboration for excellence in teaching versus institutional self-interest.

(Journal abstract)

Jevons, F. **Distance education in mixed institutions: working towards parity.** Distance Education, 5, 1, 1984: 24-37.

The "distance" in distance education (DE) is no longer

necessarily great. DE is no longer a makeshift second best to be used only where the face-to-face mode is geographically impossible. The parity of esteem which the DE mode already deserves, for mature students, has not yet been achieved, but the trend is in the right direction.

The organisational structure of Deakin University (a mixed institution that teaches both on campus and off campus) is described, emphasising how intimately DE is integrated with other university functions. In comparing DE with the face-to-face mode it is argued that distance educators should not be too much on the defensive and some advantages of DE are listed.

It is predicted that DE will continue to rise in status and expand in scale, because of its particular suitability for adult students and because of foreseeable developments in technology, especially in microcomputers. The view that it should regard itself not as a minor speciality but as a leading edge of progress for higher education as a whole is presented.

(Modified journal abstract)

Nicholls, M.G. **The demand for tertiary education — an Australian study.** Higher Education, 13, 4, August 1984: 369-377.

In this article the demand for tertiary education by successful Higher School Certificate Candidates in Victoria is modelled along the lines of Handa and Skolnik (1975). This particular component of the overall demand is studied because of the particularly plentiful and accurate information available. The estimated effect of youth unemployment on demand raises a number of interesting hypotheses related to the traditional human capital variables of opportunity cost of education and expected future returns. These hypotheses are evaluated using the developed demand model.

(Journal abstract)

C TEACHING AND LEARNING

Andresen, L.W. **Lecturing to large groups — a guide to doing it less but better.** Sydney, Tertiary Education Research Centre, The University of New South Wales, 1984, 65pp.

This guide consists of brief descriptions of ways lecturers have taught large groups. The descriptions are grouped into four major sections as follows: (1) Encouraging student activity in class, (2) Obtaining better feedback from students, (3) Encouraging dialogue in lectures, (4) Media as an alternative to lecturing. Each section contains editorial comment on the issues discussed.

(RAC)

Jennings, P.J. and Atkinson, R.J. **Learning computer programming at a distance.** Distance Education, 3, 1, 1982: 157-169.

Several strategies for distance education in computer programming are described with particular reference to the provision of computing facilities and the integration of theory and practical work. Experience from two years of presentation of two different courses has shown that the most satisfactory results are obtained with portable stand-alone micro-computers loaned off-campus, and course design based on a modified Keller plan in which each unit has interactive practical exercises preceding the discussion of theory topics.

(Author abstract)

Juchau, R. **Communication skills of accountants in Australia.** Accouting and Finance, 24, 1, May 1984: 17-32.

This paper reports a study that adpated an American communications skills inventory to determine the extent to which new graduates in the accounting profession are perceived to have adequate communications skills. Senior practitioners' and educators' perceptions were surveyed to reach conclusions regarding communication in accounting education in Australia.

(Journal abstract)

Kember, D. **External science courses: the practicals problem.** Distance Education, 3, 2, 1982: 207-225.

Three methods are described for offering the practical work for external science courses: on-campus residential school sessions, the use of centres by groups of students in a neighbourhood and the use of kits for individual study in the home. The advantages and disadvantages of each method are discussed and examples are given of each method in operation.

(Author abstract)

Magin, D.J. **Confidence and critical awareness as factors in the development of experimentation skills in laboratory courses.** Higher Education, 13, 3, June 1984: 275-288.

Major surveys of the objectives of laboratory courses which aim to develop experimental skills have identified the objectives of "critical awareness" and "developing confidence" as central concerns in course design. This study reports the outcomes of a course in experimental engineering at the University of New South Wales with respect to the achievement of these two objectives. Findings indicate that for a significant number of students the objective of developing confidence was not achieved. Further, the approaches employed to develop "critical awareness" often came into conflict with the objective of developing confidence.

A review of these results, together with other studies, indicated that insufficient attention has been given to the successful articulation of these two objectives within course design. The article concludes with a set of recommendations for meeting the objective of developing confidence in conducting experimentation whilst maintaining requirements which necessitate the exercise of students' critical faculties in resolving methodological problems in experimentation.

(Journal abstract)

Marland, P.W. and Store, R.E. **Some instructional strategies for improved learning from distance teaching materials.** Distance Education, 3, 1, 1982: 72-106.

In distance teaching we are usually concerned with indirect methods of interacting with learners, using for the most part, the written word. Quality of learning in distance education ought therefore to be closely related to the quality of textual materials provided to students. In this paper we examine some ways of facilitating learning at a distance. We begin by noting the current dearth of models for teaching through text and make a plea for diversity and experimentation in this area. Some traditional instructional strategies (including advance organisers, overviews, pretests, objectives and inserted questions) from the dominant approach to distance teaching are examined along with devices in typography and graphics. Guidelines for their use are developed, based on research, everyday rationality, and from an embryonic conceptualisation of distance learning.

(Author abstract)

Morrison, P.R. **Technical and psychological issues in microcomputer based external teaching.** The Australian Journal of Education, 28, 2, August 1984: 182-189.

A proposal is presented advocating the use of microcomputers as the prime learning tool of external students. Using the AUSTPAC Packet switching communications scheme, it would be possible to deliver course notes, receive submitted assignments from students, provide feedback, and allow communication between students, thereby eliminating the costly and clumsy mail-based liaison currently provided by many tertiary institutions. Attention is primarily devoted to the advantages and disadvantages of the proposal, in both technical and psychological terms. It is concluded that the scheme is a viable alternative provided that suitable software is provided and that consideration is given to initial attitudes of students,

pecularities in communication via computers, and the low predictive power of psychological tests in computer-based learning.

(Journal abstract)

Parslow, G.R. **Computer assisted learning by the Q instruction program.** Adelaide, Department of Biochemistry, The University of Adelaide, 1984, 23pp.

A simple authoring system for computer tutorials is described, with examples illustrating the applicability to many subjects. An instructor prepares only the text for a session indicating where introductions, questions and comments on the answers begin and end. The "Q" program formats the sesion text into true-false, multiple choice or free response question sessions for students. Although the text preparation by an author is the simplest of any available computer assisted learning package, the program provides a full range of options to students in choosing sessions and the manner in which they progress through a session. Provision is made to optionally keep records of student performance and provide item analyses of the responses. Systems with operational versions of the package are IBM-PC, BBC Computer and DEC Computers.

(Author abstract)

Parslow, G.R. **Computer assisted mark handling.** Adelaide, Department of Biochemistry, The University of Adelaide, 1984, 15pp + appendix.

This booklet describes the features of the programs used to organise student marks. The input and output of the programs cater for the routine chore of entering results and obtaining lists of results. The claimed advantages are: elimination of errors, rapidity of processing, the ability to produce notice board results without secretarial assistance, and the ability to provide statistical summaries of performance. Scaling to a pass other than 50% is an included feature. The complete program listings, in Microsoft BASIC, are included.

(Author abstract)

Richardson, B. **In text questions: a note on an experiment in instructional design.** Higher Education Research and Development, 3, 1, 1984: 81-84.

The use of instructional design is increasingly being discussed in the distance education and higher education literature. This paper reports an experiment in which self study question are inserted in the text of lecture note material for external students. An evaluation revealed that students who received notes with in-text questions were no different from those who received the standard lecture notes as judged by both performance and attitudinal criteria. Possible reasons for the perverse findings are given and it is concluded that professional instructional design assistance would be of value to subject matter experts.

(Journal abstract)

Willis, A.H. **The impact of technology on the teaching process in Australian universities.** Canberra, Commonwealth Tertiary Education Commission Evaluations and Investigations Program, 1983, vi, 82pp.

Technology, particularly electronics-based technology, is transforming the teaching process in institutions of higher education. This report on the subject arises from visits to fourteen universities in Australia, correspondence with the other five, and extensive general reading. It sketches briefly the contribution of computer technology in various kinds of subjects and its relation to educational technology in general. The indispensable partners in teaching — the library and the administration — are also reviewed from the standpoint of the effects of technology. It is shown that, with the exploitation of modern communications, distance education can make a much greater contribution to tertiary and continuing education.

The impact of technology on education is continuous and ever-changing. The institutions providing higher education will benefit from the maximum degree of co-operation in meeting it.

D INFORMATION NETWORKS

E STUDENTS

Hough, M. **Motivation of adults: implications of adult learning theories for distance education.** Distance Education, 5, 1, 1984: 7-23.

This paper attempts to address the problem of motivating adults, particularly but not only in the context of distance teaching. Its approach is needs based, in that it identifies in some detail the needs and interests of adults, due to an acceptance of a viewpoint promoted constantly in adult learning theories — that effective learning should be based on the needs and interest characteristics of the adult learner.

The paper reviews the general principles of adult learning; describes in detail the nature of the adult learner as suggested by current literature; provides suggestions for the design of learning programmes for adults; and reviews some implications for tertiary colleges and their staff, particularly those engaged in correspondence teaching, of accepting ideas about motivation derived from adult learning theories.

(Modified journal abstract)

Roberts, D. **Ways and means of reducing early student drop-out rates.** Distance Education, 5, 1, 1984: 50-71.

This paper begins by defining the term "student drop-out". Data are presented showing that the time that an external student is at greatest risk of becoming a drop-out is during the first term, semester or year of study.

The reasons for this phenomenon are explored in the light of the theories of three writers in the field of distance education, namely, Otto Peters, Börje Homberg and David Sewart.

The paper concludes by listing a number of suggestions that might be adopted in order to reduce early attrition rates and generally improve the functioning of distance education institutions.

(Journal abstract)

Sun-Mook Hong. **The age factor in the prediction of tertiary academic success.** Higher Education Research and Development, 3, 1, 1984: 61-70.

This study examined the predictive power of age in the academic performance of Behavioural Science students at the Darling Downs Institute of Advanced Education. Other predictor variables included were study methods, Tertiary Entrance score, personal problems, satisfaction with college, self-concept, locus of control and flexibility of thinking. 79 students, 93% of the total population, responded to the questionnaire containing scales measuring the above variables. Results from multiple regression analyses showed that the contribution of age outweighed by far that of any other variable. The next best predictors were study methods and environment factors. The contribution of personality traits and T.E. score was minimal. A high correlation between age and study methods was also noted. A greater acceptance of older age students into Behavioural Science courses was suggested.

(Journal abstract)

Watkins, D. **Student perceptions of factors influencing tertiary learning.** Higher Education Research and Development, 3, 1, 1984: 33-50.

An interview study about perception of factors involved in tertiary learning of 60 second year students at the Australian National University is reported. Factors which encourage deep rather than surface level processing are highlighted as are problems of transition from school to tertiary learning. An unexpected outcome was that students' responses to probing about the nature of the differences between school and tertiary learning provided evidence of qualitative differences between the way students utilising deep or surface level processing conceive the process of learning itself. This finding has implications both

for those attempting to change these students' approach to learning and for the selection of research methods appropriate for this area.

(Journal abstract)

F STAFF

Boud, D.J. and deRome, E.A. **Academics' attitudes towards and involvement in staff development activities at the University of New South Wales.** Research and Development Paper, 61. Tertiary Education Research Centre, University of New South Wales, 1984.

Two hundred and fifty six members of the academic staff at the University of New South Wales were surveyed by questionnaire to obtain information on their activities relating to staff development and their attitudes towards it. Information was sought on the following: areas of concern related to teaching and research, extent of engagement in evaluation activities, sources of assistance which had been used, willingness to allocate time to staff development, and attitudes towards the promotion system. Recently appointed staff were willing to allocate only a very small amount of time to professional development activities. They received much less help from senior colleagues than they had anticipated. Established staff attached far more importance to teaching than they perceived the University to do. One third expressed a need for some assistance with their teaching responsibilities. Lack of time and research assistants were identified as the major obstacles to their development as researchers. Some implications of the findings for institutional policy are briefly discussed.

(Paper abstract)

Meacham, E.D. **Distance teaching: innovation, individual concerns and staff development.** Distance Education, 3, 2, 1982: 244-254.

A great deal of attention has been paid to the development of instructional materials appropriate to distance teaching. In contrast, problems concerning the development of academic staff in this area have been largely neglected. There seems to be no obvious reason for this omission, as for many academics the production of materials for distance teaching is an entirely novel experience. In other words it is an innovation, which, as such, is likely to have significant effects on individuals. An example of the likely effects of innovation on individuals may be found in the "Concerns-Based Adoption Model" (CBAM), originally developed by Gene Hall and his associates in the University of Texas.

It follows that any attempt to significantly develop materials for distance teaching must be related to the individuals involved in the innovation. This article explores this relationship through consideration of a staff development model based on the levels of concern of participants and the requirements of sound instructional design.

(Author abstract)

Zuber-Skerritt, O. **A personal view on staff development.** Zeitschrift für Hochschuldidaktik, 6, 4, 1982: 348-357.

The paper argues that Staff Development (SD) through general programmes and workshops on learning and teaching is less effective than (1) through indirect SD (i.e. working with teaching staff as they design, implement, review and adjust their courses), (2) through the facilitation of staff self-development (i.e. introducing faculty staff to methods of reviewing their own courses), and (3) through institutional management of faculty staff (e.g. the University's course approval and review system).

It is the individual staff's responsibility to engage in continuous self-evaluation and self-development activities. It is the University's responsibilty to ensure that SD occurs by means of its reward system, an SD policy and by providing professional advice (e.g. by a unit/centre).

(Journal abstract)

Zuber-Skerritt, O. **Exploring the organisational and political boundaries of staff development within an institution.** Proceedings of the Seventh International Conference on Improving University Teaching, Tsukuba, Japan, 1981: 290-299.

The paper discusses the need for an institutional policy on staff development and the recommendations of the AVCC Working Party on SD. The report of the Working Party is interpreted in the light of the political and economic climate in Australia, especially since the "Razor Gang" Report. The paper identifies some major conditions for the successful implementatin of an institutional policy on staff development.

(Author abstract)

ABSTRACTOR

R.A. Cannon, The University of Adelaide

Deadlines for copy for HERDSA NEWS 1985

March issue: 11th February 1985

July issue: 1st June 1985

November issue: 1st October 1985

Editor:	Dr Dave Boud, Tertiary Education Research Centre, University of New South Wales, Kensington, NSW 2033
Guestt Editors:	Dr Elizabeth H. Hegarty, School of Microbiology, University of New South Wales, Kensington, NSW 2033 and Mr Michael T. Prosser, Centre for Teaching and Learning, University of Sydney, NSW 2006
Typesetting:	Anna Tsakaros
Production Supervision, and Layout:	Ian Dunn
Cover Design:	Carole Griffin
Printed by:	Clarendon Printing, 91 Anzac Parade, Kensington, NSW 2033