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# Expert and novice teachers compared : a comparison of their roles and functions with implications for teacher education

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# "Expert and Novice Teachers Compared: A Comparison of their Roles and Functions with Implications for Teacher Education"

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# Expert and novice teachers compared: a comparison of their roles and functions with implications for teacher education

What is the nature of expertise and what characterizes expert performance? What features of cognition and problem solving are typically associated with a highly proficient performance? At one level the answers to these questions are obvious. By definition, expert performers are highly knowledgeable of their subject disciplines and capable of very competent performances in their particular fields of endeavour. The expert in the present context refers to those with knowledge and the ability to apply that knowledge. This definition excludes the ivory tower stereotype: that is, the person with theoretical knowledge without practical or applied knowledge. But the definitional parameters of expertise are not my real concern; instead I intend to look beyond the obvious truths to the generic cognitive, psychological and behavioural attributes linked with expert performance. My eventual goal is the explication of the nature of expert teacher behaviour. This endeavour requires a review of recently published theoretical and empirical research papers in this area, including an account of some of my own work on this topic.

Let us start with a preliminary framework for a theory of expert behaviour. Glaser and Chi (1988) have given us an overview of the characteristics of expert performance. The attributes associated with expert performance have been studied in the fields of artificial intelligence, chess, diagnosis in medicine, executive behaviour in business, and in a great number of other occupations (Chi, Glaser & Farr, 1988). The Glaser and Chi (1988) framework provides a basis for much of what I want to discuss in this paper. The theoretical framework can be summarized in seven basic propositions. These are depicted in Table 1.

First, experts excel in their disciplines and are highly knowledgeable in their specific fields of endeavour. These are attributes typically observed in one domain, not in many. It is very difficult for experts to change occupations or subject domains and excel in a new field, at least in the short or medium term. Expert sculptors, for example, do not usually become highly skilled musicians, though of course in some instances experts do become reasonably proficient in other domains. It is not unusual for skilled surgeons to become expert bridge players, but it is rare for experts to excel in more than one field of professional endeavour. The research evidence indicates that becoming an expert in one domain does not transfer readily to another, mainly because expertise in any one domain requires background knowledge, experience and commitment to that field that is difficult to replicate elsewhere (Chi, Glaser & Farr, 1988).

Second, experts are able to perceive large meaningful patterns within their unique domains. Experts are very good at finding coherent patterns within data drawn from their subject fields. They are able to discern if particular patterns are meaningful or anomalous. What may seem to an observer as inchoate data will appear to an expert eye as an integrated display having substantive potential meaning.

TABLE 1

**Characteristics of the performance of experts (after Glaser & Chi, 1988; and Locke & Latham, 1990)**

- Experts excel mainly in their particular domains
- Experts perceive large meaningful patterns in their domains
- Experts are fast : they are faster than novices in performing skills in their domains and quickly solve subject-related problems with few errors
- Experts have superior long-term and short-term memories for data in their domains
- Experts represent problems at a deeper and more principled level than novices : novices tend to represent difficulties at a superficial level
- Experts spend more time than novices in examining a problem qualitatively
- Experts have strong self-monitoring skills
- Experts have a strong commitment to achieve high-level goals in their domains
- Experts typically demonstrate high self-efficacy

Third, experts are quick to resolve routine problems in their individual domains. This is suggested by the definition of expertise. Everyday observation of any expert in action will confirm this generalisation. The expert typically goes to the heart of the matter, discerns the obvious difficulties to be solved and unravels these, seemingly without effort. There is an alacrity in the way expert chess players complete their tasks; likewise highly competent medical scientists are usually able to diagnose disorders and seemingly complex biomedical problems with effortless skill.

Fourth, experts spend more time than novices in examining a problem qualitatively. Experts are sensitive to the validity of input datum and the correct manner of its interpretation. They routinely spend more time than others in looking at the multiple dimensions of any conundrum in their domains. Expert bridge players are particularly good at this kind of endeavour and look beyond the simple point-counts to likely distributions of cards in other players' hands. In situations in which the problem may be ill-defined, the expert is more cautious than the novice and more sensitive to the cost-effectiveness of potential solutions to problems.

Fifth, experts have more efficient long-term and short-term memories for subject matter within their particular domains. For example, expert chess players will remember game formations displayed years previously. Skilled surgeons will have near perfect recall of standard and deviant patterns in body structure and disease.

Sixth, experts perceive and represent problems at a deeper and more principled level than do novices. Experts are sensitive to the more complex aspects of problems, the quality of any proposed solutions and the likely long-term consequences. Experts apply principles from theory in assessing data and deciding courses of action; they follow up with adroit application of problem solving principles in seeking solutions to difficult situations. In contrast, the novice is attracted to the simple and easy compromise. The novice is more likely to look for any action that may provide an immediate resolution to a perceived problem.

Seventh, experts have strong self-monitoring skills. Experts constantly monitor and assess their thinking and problem solving. This is the realm of the metacognitive, in this case the thinking that goes on in experts' minds about their particular thought processes. Talk to expert mathematicians midway through a given problem and they will inform you that they constantly check to see if their part-solutions are consistent with theoretical expectations. Experts can also make astute judgements about the thought processes and actions of others attempting to solve problems in the same domain.

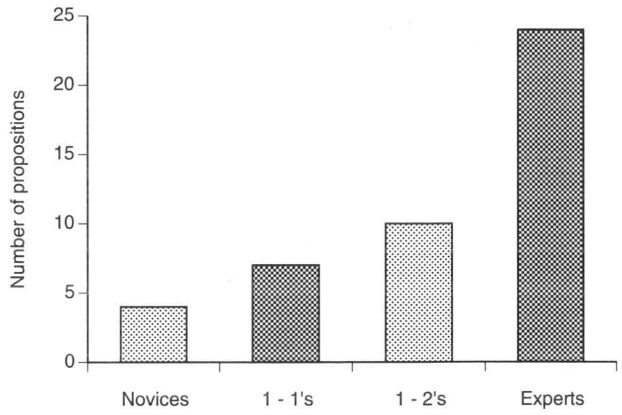
Two additional propositions are included in the schedule listed in Table 1, both drawn from motivational components of goal theory. I will call these the eighth and ninth propositions and they relate to Locke and Latham's (1990) high-performance cycle of goal theory. The propositions are as follows: the eighth, that experts have a strong commitment to high-level goals in their particular domains and set exemplary standards for performance in these domains; the ninth, that experts have high self-efficacy for achievements in their professed subject areas. A substantial body of empirical research supports the validity of these propositions. They can be shown to fit neatly into the Glaser and Chi framework. The nine-proposition list is a useful summary of what is known of the attributes of expert performance.

I introduce one final point of illustration before I depart this theme. It will be recalled that Glaser and Chi (1988) highlighted the finding that experts know the background theory and its application far better than novices. Let me demonstrate this point with some data from a recent research study. The results (Figure 1) from Boshuizen and Schmidt (1992) on the knowledge of experts and novices in the medical field reveal important relationships.

The experts were skilled medical practitioners and the novices were medical students. The novice medical practitioners were expected to do well as they had recently completed intense academic courses in the particular subject area. Both groups in this research study were asked to explain the biomedical and pathological processes related to particular disease states. Figure 1 shows that the experts outperformed the other groups convincingly: expert medical staff (the group depicted on the far right) had far better understanding than novices. The expert medical staff knew far more about the causes of disease than novice undergraduates. Clearly, both the theory and its application were better known by medical experts, a finding that should give all of us private comfort next time we wait uncomfortably in the waiting room of our specialist medical practitioner.

FIGURE 1

**Number of propositions supplied by subjects (novices, interns and experts) in explaining the pathophysiological processes that caused patients' complaints (after Boshuizen & Schmidt, 1992).**




My task is a challenging one; the goal is to see if the role of the expert teacher is congruent with the preliminary theoretical framework already outlined. Do expert teachers involved in problem solving in class typically demonstrate the same pattern of cognition and behaviour as other experts? Do experts in medicine, chess and teaching share similar cognitive characteristics with teachers? This is a critical question for all those concerned in the preparation of teachers. This leads naturally to another more applied question. What does research tell us about the educational programmes that best develop expertise in teaching? Put another way, what should universities do to encourage their novice teachers to develop into master teachers? The answers have relevance for both undergraduate and graduate education and for our present concerns in higher education, particularly in regard to matters of quality control.

Before we move on I must introduce yet another conceptual framework. I have chosen the excellent Kennedy (1987) model of the teacher's professional role. It is central to my case and I will refer to it several times in the course of this lecture (Table 2). Kennedy has proposed a four-level model of professional competence and related it to a multilevel conception of expertise.

TABLE 2

**Kennedy's (1987) levels of expertise**

1. Expertise as technical skill (development of competencies)
2. Expertise as the application of theory and general principles
3. Expertise as critical analysis (judgement of appropriate action)
4. Expertise as deliberate action in the work place (including high-level problem solving abilities)

The first level of expertise is based on a model of technical skill. This in essence is a model of expertise based on fundamental competencies: a model for the description of basic attributes of occupations that we have heard a great deal about in the last twelve months. It has a long history in educational thought. It was first proposed by Charters and Waples (1929). This model is based on the belief that teaching 'can be broken down into discrete units; each unit can be defined as an observable behaviour and each unit can be taught to prospective teachers independent of other units' (Kennedy, p.134). Its practical logic implies that a principal of a school selecting expert teachers may ask applicants: Have you acquired expertise in all the teaching competencies or specific skills required for efficient instruction in your field?

The next is the model that describes expertise as the application of theory or general principles. Universities generally favour this model as it is said to meet the rigorous standards set by the traditional disciplines for professional education. Faculties of education generally give this model great support. On this basis students are taught theories of child development, human learning and pedagogy because it is said that this content informs teachers about the principles that should guide educational processes. A headmaster interviewing an applicant for a senior teaching position (that is, seeking an expert performer) may ask: Do you know and understand the principles and theory that ground efficient teaching in your particular subject area? Have you expertise in the underlying theory and do you understand the principles well enough to put them into practice?

The next level emphasises the role of expertise in critical analysis. Lawyers tend to support this view. What individuals know is important, but more important is whether they are able to analyse critically the material being presented and determine appropriate solutions to problems after careful scrutiny of data. The principal who has a preference for expertise in critical analysis would look to recruit experts from the teaching profession with practical intelligence and critical judgement.

The last of these four levels is what Kennedy calls expertise in deliberate action. It posits a critical interaction between thought and action and work place proficiency. This view is that expertise develops with experience; that there is no point in expecting that an educational regime of any kind will be of major importance in the development of expertise; the only real training ground for the development of expertise is the work place, in our case the classroom and the school. In this view the university may be the place for basic competencies, introductory theory and critical analysis, but schools and classrooms are where expertise is really developed. A principal hiring experts and having this model in mind may ask a great deal about previous school experience and teaching practice.

Most of us would claim this four-level model is comprehensive, but that we need not apply a disjunctive logic to practical decision making in this area. Rather, we should see some value in each of these categories: that for different expert roles in education and in different contexts, inclusion of criteria from all of these levels is more likely to lead to better selection of staff. Too much emphasis on competencies is a mistake, and too much emphasis on practical experience or any of the other categories is also a mistake. The real challenge in developing expertise is to find the right balance of basic competencies, knowledge of theoretical principles, critical judgement and practical experience. The principal hiring expert staff should perhaps ask questions related to all the dimensions included in the model. I will assume this is a reasonable conclusion, especially as there is little evidence in the research literature that any one approach on its own is likely to lead a well-rounded expert professional, and clearly there is much value in elements from each of these models in any programme of teacher education.

All the theoretical components are now in place. Now to the second part of my paper. I plan to describe briefly three research projects from the United States in the field of expert teacher behaviour. These research studies provide data on some of the correlates of teacher expertise; more importantly, they also provide knowledge about the limits of possible effects of expertise in different educational contexts. The fourth study is derived from my own research work done in Western Australia with teachers in the Ministry of Education's Swanbourne District.

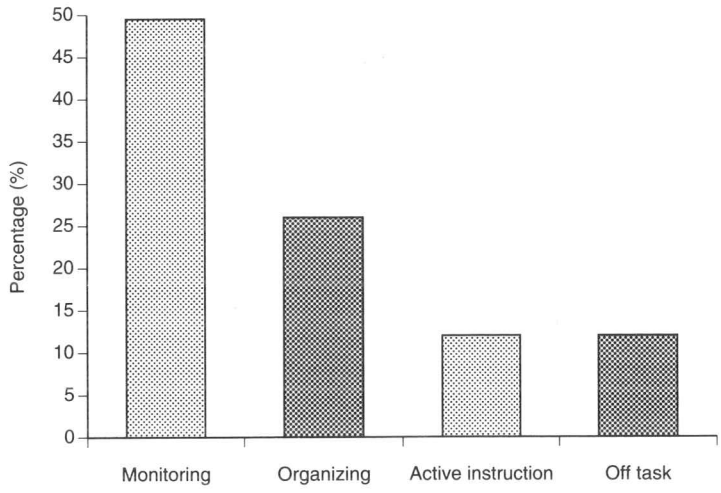
## Stallings

Stallings (1986) has written extensively on the subject of teacher competency and has a particular interest in reading education. Her sample for the research study I will report today was drawn from secondary-level teachers and students in the San Francisco Bay area in the USA. Thirty-six secondary classes participated in the study. Observers recorded the classroom activities of these teachers in their classes and the level of interactions between teachers and their students over several months. The Comprehensive Test of Basic Skills (CTBS) was used to record reading levels and gain scores.

Partial correlations were used to analyse the relationships of interest, with initial pretest scores held constant for the analysis. Twenty of the thirty-six classes did not show gains in reading over the period based on regression techniques, and the teachers of such classes were classified as no-gain teachers. In contrast, the expert teachers in this study were defined as those who prompted measurable gains in the reading scores of their students. Stallings also used an average group for comparison purposes. Stallings was interested to see how expert, average and no-gain teachers differed in the way they allocated their time in class. The average teacher's time allocation is depicted in Figure 2.

FIGURE 2

**Average use of time (all teachers) during 50-minute reading periods (after Stallings, 1986).**

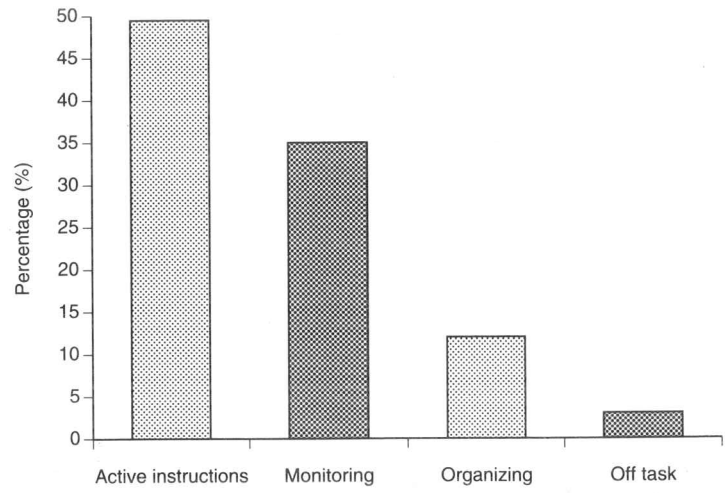



Stallings found that on average teachers spent only 12 percent of their time providing active instruction; this being defined as giving explanations, asking questions, marking homework and other teacher behaviours of like kind. This level is low, but it is consistent with other US findings on time allocated to instruction in reading classes. Clearly, teachers in the San Francisco area considered that setting assignments, monitoring progress and organizing learning experiences during class were more important than active instruction. The students in average classes were also off-task for much of the time. In essence, and unfortunate as it may seem, the general picture that emerges is of the average teacher as a dispenser of work assignments and monitor of student behaviour during assignment completion.

Let us now examine the same pattern of variables for the expert teachers (Figure 3).

FIGURE 3

**Use of time by effective teachers. Time allocated during 50-minute reading periods (after Stallings, 1986).**

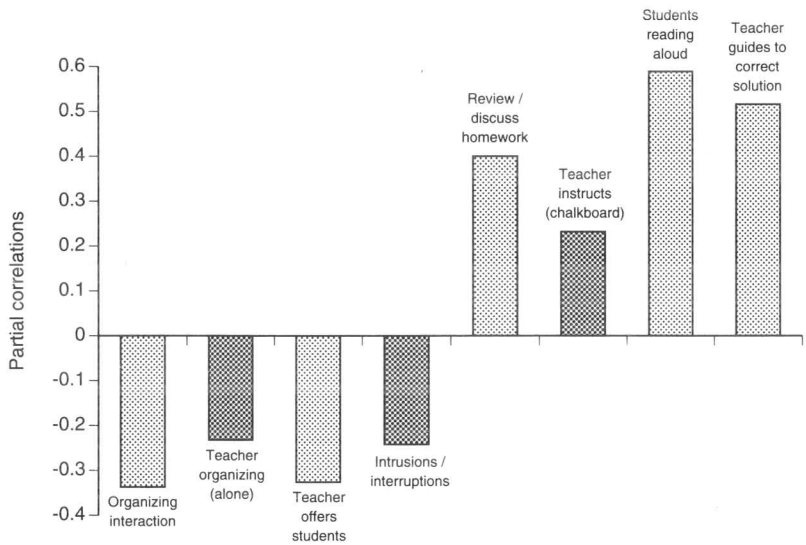


The pattern of time allocated to different functions by effective teachers is very different from that recorded for average teachers. For the expert teacher the percentage of time spent in active instruction is far higher than that of the average teacher. Note also that the expert teachers spent relatively little time in organizing instruction during class time and less time monitoring instruction. Experts aim to facilitate learning directly; they do not waste energies on tasks that do not facilitate learning; they are cost-effective; they explain and demonstrate; they are task-oriented and are good managers of learning.

The particular pattern of results is depicted in another way in the next set of data. Stallings examined the block of data for all students and teachers in all schools included in the study. Figure 4 depicts bars above the line and bars below the line; those above the line are positive correlations; those below are negative correlations. The separate bars in the diagrams refer to different measures of each dimension; in this figure you will note several bars for teacher organizing behaviour and several for active instruction.

FIGURE 4

**Partial correlations between reading CTBS scores and selected process variables, including active instruction and teacher organizing behaviour (after Stallings, 1986).**

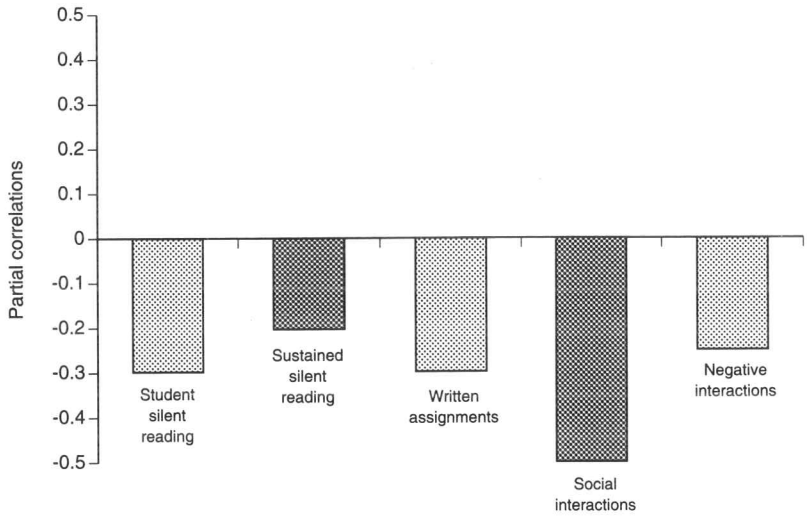



Note that all the measures of active instruction correlated positively with reading gains; all the measures of teacher organizing during class time correlated negatively with reading gains. A second figure (Figure 5) shows the other correlations: the several measures of time allocated to seat work (that is, doing 'fill-in' assignments during class time) correlated negatively with reading gains; likewise all the measures of student off-task behaviour (eg in socializing) correlated negatively with achievement.

In overall terms, teacher interaction, teacher feedback and teacher reviews of homework, summarized as active teacher instruction, were all correlated positively with learning gains. All the other variables predicted low rates of student progress. In general, these data support the Glaser and Chi (1988) conclusions. Experts almost invariably demonstrate different patterns of problem solving performance and activity from non-experts. Experts deal with the key issues and do not waste time on inessentials. They understand the relationship between certain types of instructional activity and high student performance. These data also indicate that expert teachers devote more time to those features of instruction that have been found in other empirical studies to be causally related to gains in students' learning.

FIGURE 5

**Partial correlations between reading CTBS scores and selected process variables, including seat work and off-task behaviour (after Stallings, 1986).**




Of course, this research does not tell us what would have happened if the average and inexpert teachers had used the same processes in class in the same way as expert teachers; nor do they tell us whether they would have obtained the same order of gains in reading scores as expert teachers if they had allocated their time in the designated 'expert' manner. All Stallings has done is demonstrate a pattern of associations among variables. We note this obvious weakness in the purely correlational analysis of Stallings' data, but even so the depicted conjunctions are of great interest.

## Leinhardt

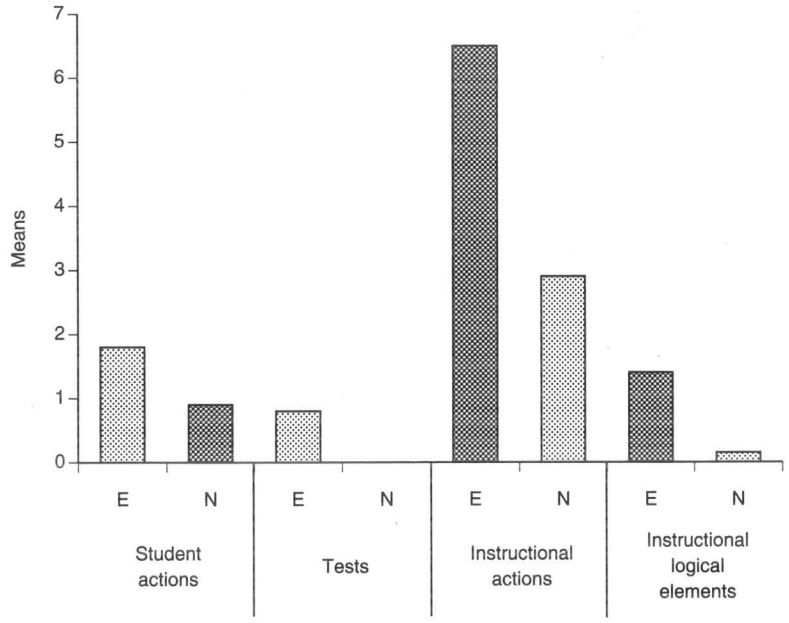
Next I turn to redoubtable Leinhardt (1989) and her study dealing with the teaching of mathematics, this time in primary school classrooms. Expert and novice teachers were observed over a three and one-half month period. The experts were highly skilled teachers whose students achieved high scores in mathematics; the novices were student teachers. Both groups of teachers were given new material to teach. Experts and novices were questioned at interview before and after lessons. I will comment on only one aspect of the teachers' work; that is on the operational plans of experts and novices revealed prior to lessons, and the subsequent pattern of teacher behaviour and student learning. The results of the study are as compelling as anything else in the expert-novice research. A comparison of the means of expert teachers and novice teachers on dimensions of interest is revealed in the next figure (Figure 6).

The expert teachers had talked more extensively about their plans and these were more complex than those of novices; they had planned more instructional activities and anticipated students' actions more frequently. Expert teachers planned more checks on students' responses than novice teachers. As well, the experts made links between previous work taught and present instruction and demonstrated more logical direction than novices in the prepared content of lessons.

These findings are in general agreement with the findings reported by Stallings. But this study tells us a lot more, especially when the transcripts of the interview data provided by Leinhardt were examined in detail. Expert teachers had very sound knowledge of the subject area and complex schemas about the nature of instruction; they planned and effected articulated connections between aspects of lessons; they applied well-rehearsed action systems; they adapted to different instructional situations and kept to the goals of instruction without becoming diverted by irrelevancies. The mental maps of experts were full of routines used previously to produce changes in learners' thinking. They reflected continually on their actions in respect of students' learning. They concentrated their focus on students' learning far more so than novices. The expert teachers worked with more complex and cost-effective routines; strategies that were adaptable to different levels of student responses.

FIGURE 6

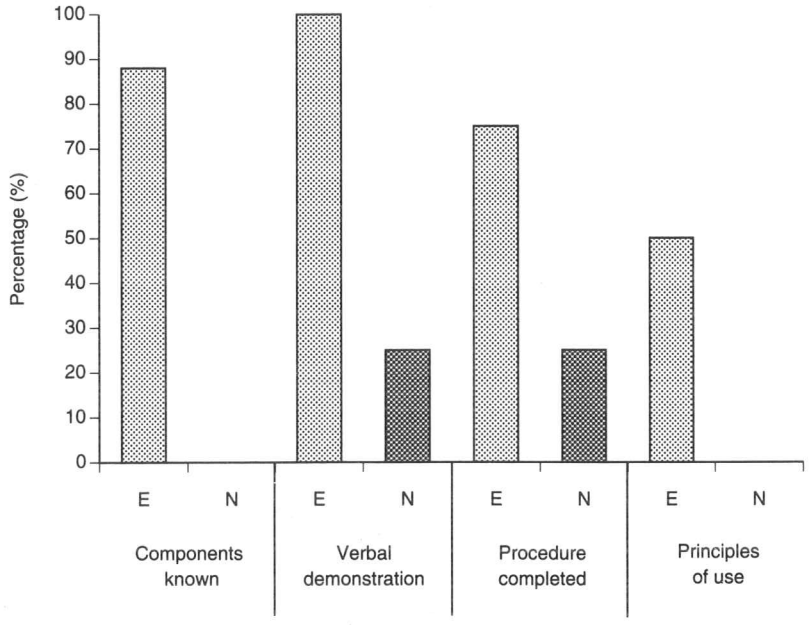
**Experts (E) and novices (N) compared on teaching agendas: mean number of actions, tests, instructional actions and instructional logical elements (after Leinhardt, 1989).**




In the next figure (Figure 7) I demonstrate the goal completion activity of experts and novices from the Leinhardt data.

FIGURE 7

**Experts (E) and novices (N) compared on percent of explanations reaching desired goal level (after Leinhardt, 1989).**



Notice that the experts completed at a high rate of success the goals they had set for their students and themselves. They had set high goal standards for themselves and their students. In numerical and concrete demonstration in verbal demonstration, and in procedures completed the experts did far better than novices. In contrast, novices reported that they had goals for instructional tasks, but did not achieve many of these self-set goals. They did not set many goals of any real quality, and often did not achieve the specific goals they had set themselves. Goal theory would predict a very low performance by students taught by such novice teachers; the results of the research confirmed this expectation.

Overall, observations of novice teachers indicated less coherent performances, more interruptions to instruction and more wasted time, and although they had reasonable knowledge of subject matter they often presented incoherent explanations of particular concepts. They were far more variable in their responses, particularly in coordinating lesson components. No novice teacher mentioned an intention to check if students understood content; novices lacked contingency plans if a lesson failed to develop in the way they thought it should. They were unable to analyse the significance of students' responses to instruction.

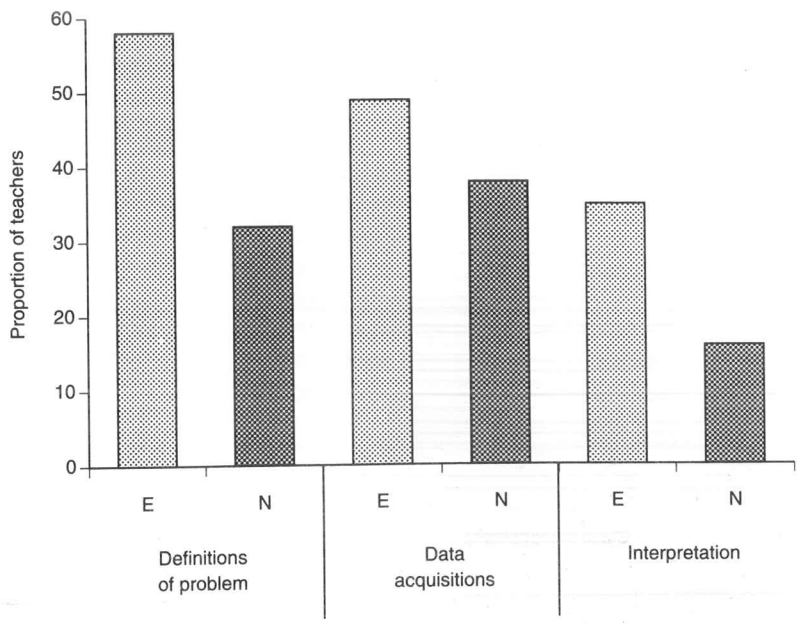
The link back to Glaser and Chi (1988) and the high-performance goal model of Locke and Latham (1990) can now be demonstrated. Expert teaching in the Leinhardt case conforms in most ways with these models. Teaching is complex, requires the discernment of patterns, speed of action, rich knowledge of the subject area, goal direction, commitment, and a schema-driven framework. The findings are also consistent with attributes outlined in several levels of the Kennedy model. Expert teachers demonstrate an array of competencies, a store of principles for the guidance of action, critical judgement about when to apply particular strategies and a capacity to reflect on strategies and their products. In contrast, novice teachers are relatively inefficient and find difficulty in coping with the typical profusion of classroom activity. Novices lack the attributes of the expert as defined in the model described in the early part of this paper.

## Swanson, O'Connor and Cooley

Now to the third of the published papers. Swanson and his colleagues (1988) examined a somewhat different research problem. They were interested in teachers' reactions to behaviour problems in the classroom. The expert and novice teachers in their study were presented with vignettes (in this case verbal descriptions) that gave accounts of student problem behaviours. The teachers were asked to judge how they would react to the situations depicted in the vignettes if they had to deal with them in a classroom context. A "think-aloud" procedure was employed to record teacher reactions to these problem behaviours. A count was taken of the subjects' choices of heuristics (that is, strategies) used by the expert and novice teachers. The next figure (Figure 8) illustrates some of these relationships.

FIGURE 8

**Percent of teachers in the indirect condition that used all possible mental components within a particular heuristic (after Swanson, O'Connor & Cooley, 1988).**



The teachers' responses were categorized according to predetermined criteria. The research data revealed that experts were far more inclined to favour the categories of definition of problem, and data acquisition and interpretation heuristics. The experts sought more information, wanted to know exactly what kind of behaviour problems were represented, and sought relevant background before suggesting solutions. Diagnostic and analytic attributes motivated the expert teachers. In contrast, the novice teachers tended to react to the surface information given to them and were more likely to seek quick and easy solutions to problems recounted in the vignettes. The novice teachers opted for immediate solutions, even though the data did not suggest that the problems were simple or solutions would be easy.

How does these findings accord with the Glaser and Chi theory? In general, the results conform very well with the theoretical perspectives already outlined. In Swanson's terms the experts demonstrated a "more principled representation of their thought patterns and are very adept at pattern recognition" (p. 546). The experts had more strategies to deal with problem behaviours, but were hesitant to use these strategies until they knew the dimensions of the problem situation. The expert teachers sought more qualitative information than novices in the same situations.

## Cole

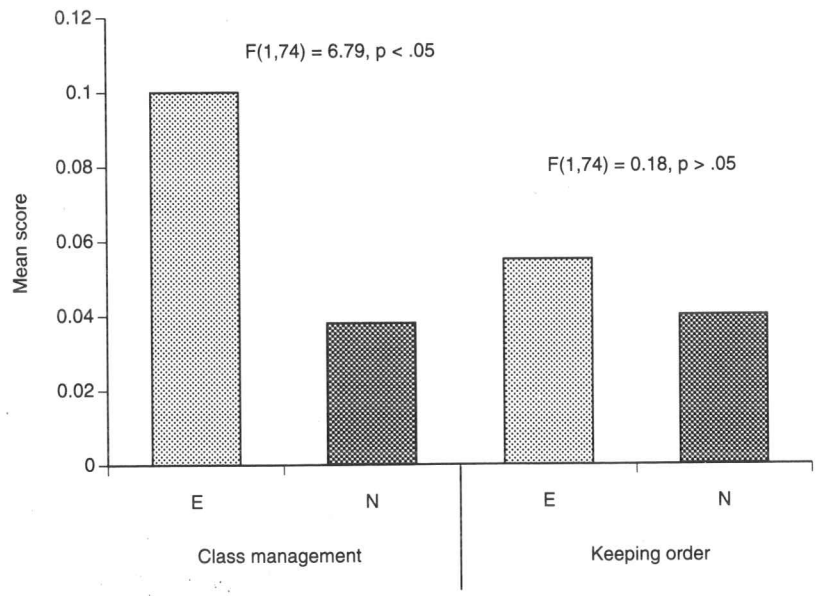
Now to my own research. I have taken aspects of research on expert-novice research one stage further. My interest was in expert and novice teachers' responses to questions about classroom functions they considered important to teaching. I used magnitude scaling instrumentation to determine attitudes and asked all subjects questions about what they 'emphasise' and 'think important' in their teaching.

The expert teachers in this study were chosen from primary schools in the Swanbourne district. Two teachers were chosen from each school in the district; altogether 38 teachers were in the final sample. The teachers were chosen on the basis of principals' recommendations; each principal nominated two teachers classified as outstanding or expert on the basis of improvements in students' learning and the positive nature of personal relationships within their classes. The novices for this study were 38 third-year education students on the Churchlands campus of Edith Cowan University about to be placed on final teaching practice.

I asked both groups to rate the degree to which the average teacher in Western Australia emphasized a number of teaching functions; then to rate themselves on the same functions. Typical paired questions were: 'How much does the average teacher emphasize control of students in teaching?' and 'How much do you emphasise control of students in teaching?' I wanted to assess how important they thought such functions were in their teaching. The next figure (Figure 9) depicts students' and teachers' responses to questions about control and class management.

FIGURE 9

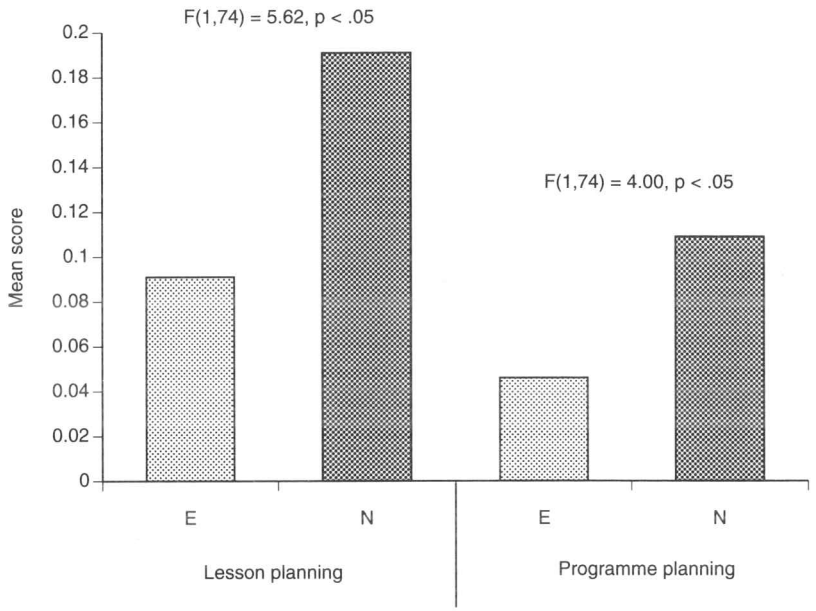
**Expert and novice teachers' views on the importance of class management and keeping order.**



Both experts and novices rated their estimates of the importance of these functions higher than they rated the average teacher's response. The two groups differed markedly in their judgements of the importance of classroom management; however both experts and novices rated control (that is, discipline) to be of equal importance in classroom functioning. The experts considered the management aspect of their role far more important in normal class teaching than did novices. This is a critical finding, because the third year students had spent considerable time in class studying the importance of management functions, yet still did not match with experts in their judgement of the importance of these functions. In contrast, the superficial aspects relating to discipline and control are considered equally important by experts and novices; the importance of the broader and multifaceted aspects of class management were not appreciated by novices.

The experts and novices were compared on their judgements on the importance of planning. To what extent did these groups consider that the planning function was important to teaching? The data are revealed on the next figure (Figure 10).

## FIGURE 10
**Expert and novice teachers' views on the importance of lesson planning and programme planning.**

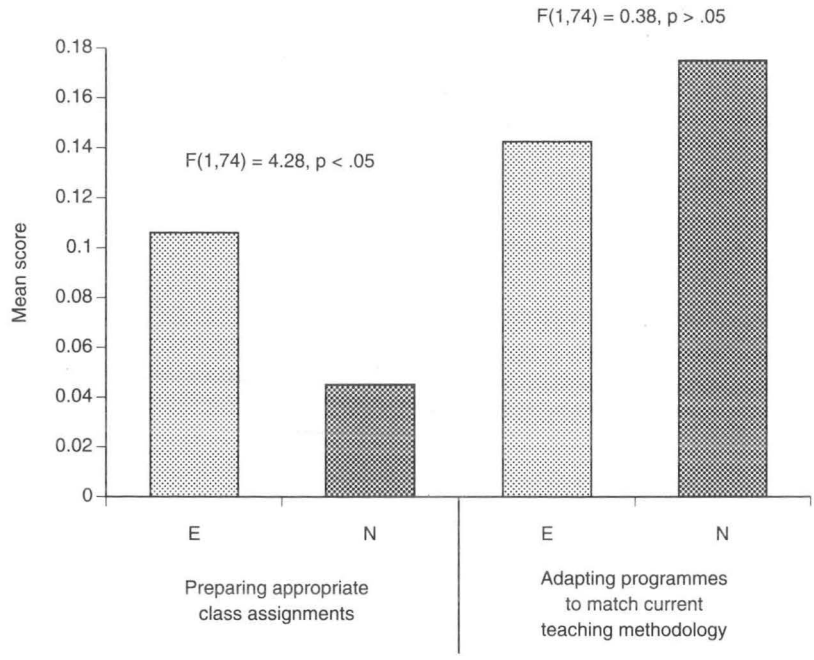



Lesson planning and programme planning were considered more important by novices. Experts were less convinced of the value of these teaching functions. On reflection this may not be too surprising. Staff in Edith Cowan University have stressed the importance of planning subject area programmes and students have absorbed messages about the importance of this aspect of teaching. Expert teachers, in contrast, have structured much of their planning in mental maps and do not expect to do an excessive amount of formal planning, though as indicated above they considered this aspect of teaching to be more important than that attributed to the average teacher in schools. The next figure (Figure 11) reveals some of the important differences.

In the day-to-day work of preparing appropriate assignments, the experts and novices differed; experts gave more weight to preparing class assignments than did novices. This may be related to the differences between the groups in judgement about the importance of classroom management referred to earlier. On adapting programmes to match with current teaching methodology both experts and novices agreed on the measure of its importance, but the two groups could not be differentiated (the graph seems to indicate a difference, but it was not significant).

FIGURE 11

**Expert and novice teachers' views on the importance of preparing class assignments and adapting programmes to match with current teaching methodologies.**




In summary, a mixed picture is revealed. Experts and novices disagreed on the emphasis that they considered should be placed of several teaching functions. Classroom management is possibly the most important of these. One should not infer from this that the expert teachers in the present study supported punitive or authoritarian attitudes; rather they perceived that 'getting class management right' was vital to their concerns about proficiency in their role. Novices were less concerned than experts about this function, though they did support the view that it was an important aspect of their role relative to that emphasised by average teachers. It should be noted that the Teachers' Charter recently published by the Australian Government does not list classroom management as one of the priorities for effective teaching (Schools Council, 1990). A reverse effect was observed in planning; novices rather than experts rated the planning function as being more important to teaching performance. On both scores, it could be claimed that novices lacked the mature judgement of experts as reflected in the different weights given these different teaching functions.

## Implications

This paper contains a review of only a few of the many studies on the differences between experts and novices on key elements of cognition, teaching style and behaviour. There are many other papers that reflect these themes and draw similar conclusions. It is now appropriate to summarize the content of what has been explicated above and draw further conclusions from the wide range of published papers in the area. .

Let me remind you that the studies I have used here are all correlational and as such demonstrate only comparative relationships among displayed sets of data. Comparative studies of this kind do not imply that beginning teachers or novices can be easily trained to think or behave as experts; nor that the end result of any education of novices will always lead to high levels of student learning commensurate with the performances of students under expert tutelage; nor that the task of training novice teachers to behave and think like experts can be completed within the framework of time at present allocated to professional training. The task of training experts is a difficult one, but at least the research done so far has given us some suggestions for better quality service delivery, particularly in the realm of graduate training (Higher Education Council, 1992).

We should realize that expertise in teaching is not based on a simple competency based model; rather on a concatenation of the attributes of experts described in the Glaser and Chi (1988), Kennedy (1987) and goal theory frameworks (Locke & Latham, 1990). The evidence suggests that expert teachers do not behave like skilled technicians but like experts in other fields of endeavour. Expert teachers use problem solving skills in deciding what to do and how to achieve prescribed objectives. In many situations they reveal a wide range of competencies; but more than that they reveal judgement about what to do, how to best achieve it, and how much to press to achieve vital objectives. Expert teachers apply principles; they reflect on the needs of their clients; they are constantly searching for ways to maximize outcomes; and like other professions they use reflective judgement in decisions about appropriate actions. The contrast with the novice could not be more compelling. The latter almost always lack competencies and reflective judgement and their reasons for action in teaching contexts almost always lack credibility. Novices are unable to make a link between sound theory and practice.

We need to intensify our research on the attributes of expert teaching. This seems patently obvious: I wonder why I need to stress it here. But I do, because rarely do those who conduct research on teachers or write reports for governments on teaching seem to consider the necessity to scrutinize the varied and multi-dimensional work of expert teachers. Many of the official documents issued by governments on teaching seem derived from management dogma rather than on empirical evidence or sound theory based on expert teaching.

The schools should do more to document and analyse the performances of their expert teachers. The research completed by Leinhardt (1989) is a model for this kind of activity. Her detailed studies of the plans and strategies used by successful teachers are one of the best sources of data I know for aspiring teachers. She demonstrates that one of the essential characteristics of the expert teacher is the capacity to integrate the diverse elements of teaching into a coherent plan of action. Innovations in method, technique and theory in recent years do not alter this essential requirement. The universities also need to explore and analyse this issue. Researchers in universities should ask teachers in nursing, business, education and the other faculties what they do and how they achieve such well-recognised quality outcomes. We recognise the outstanding qualities of our expert teachers in universities by giving them awards; an account of the procedures they use to achieve such results would do a great deal to stimulate high achievement in others. An account of the conceptual schemes that are the basis of their teaching would advance our cause even further.

We need to intensify our efforts to understand the cognitive dimensions and multi-dimensional instructional schemes of expert teachers. These schemas are the cognitive components that drive such teacher's actions. The cognitive components are comprised of complex cognitive maps and principles of instruction that promote proficient learning (Borko & Livingston, 1989; Leinhardt, 1989). Teachers have to think about many things at once; they often strive to achieve several apparently disparate objectives in a relatively short time frame. In any short time interval, expert teachers are typically thinking about how to give appropriate feedback; or the next instructional step; or how to assess the students' learning; or how to assuage the hurt felt by students unable to achieve a pass score on a test. The internalized schemes that drive the expert teacher's actions are derived from the memories of successful strategies used in past instructional sessions.

But what mechanisms explain the subtle cognitive processes of the expert teacher and how do these differ from the average and less proficient? Why, over time, do some teachers become proficient and others remain like novices? These questions have no definitive answers at this time. In my own field of special education there is very little research into the characteristics of expert teachers working with children with developmental and behaviour disorders. Less still on the cognitive demands that these teachers place on themselves to integrate the many dimensions of their roles. The issue of expert teaching in special education should be given far higher priority.

We need to promote better ways to simulate expert teaching and include these in teacher education programmes. By simulation I mean forms of instructional processes that provide model activities that parallel the leadership roles required in traditional classes. In this context, several authorities have emphasised key communication skills for students in teacher education (Cole, 1993). For example, students in undergraduate education classes may be required to give class presentations or take leadership roles modelled on those given by experts. In my view model lessons delivered by undergraduates to peers are an excellent form of preparation for teaching, especially if these can be made challenging projects and require strategies similar to those used by expert teachers in classrooms. My frame of reference is goal theory (Locke & Latham, 1990), and Bandura's (1986) concept of enactive learning. In such situations the more challenging we can make these simulations and the more we can encourage conception matching the better the chance of high-level learning.

Some of those in my audience may say that laboratory and tutorial classes already allow modelling of good teaching practice. My observation of teacher education in universities in Australia is otherwise. I rarely see students in simulated teacher roles while working in university classes. I have observed a great deal of small group work; I have seen much group discussion and tutorial work; I have monitored a great deal of forceful lecturing by staff and I have seen a good deal of microteaching with compliant pupils from local schools; I have also observed small-group presentations by education students, most often in low stress situations. But much of this kind of activity is routine and uninspired. There is a need to revitalize these outmoded instructional systems. In my view we need to think of better ways to involve our students in instructional and leadership roles that reflect the routine tensions and urgency of everyday classroom work.

In the same context: Why are there so few computer-based learning components in standard core programmes in teacher education: these will undoubtedly be major instructional tools in the next century? Why are there so few mastery learning programmes in teacher education when research shows how effective they are at university level? The most recent issue of the International Journal of Educational Research (Montague & Knirk, 1993) on adult education confirms these importance of such variables in current thinking about higher education.

We need to investigate the ways in which expert teachers deal with the stresses and complications of teaching. I have looked in vain in official documents issued by government for reference to the intricacy of interactions among relevant teaching context variables. In the language of research methodology, very little of functional teaching in classrooms has to do with unambiguous main effects; rather with the complication of interactions among methods, situations and student characteristics. On the same theme, I must say that even in this modern age it is rare to see a video or film of the performance of expert teachers coping with the complexities of instruction. I have seen many films and videos dealing with short excerpts of idealized instruction, but it is rare to see the really expert teacher dealing with the intricacies of method, in different instructional environments with students of varied levels of ability and motivation.

We need to consider the philosophical dimensions of the relationship between expertise and authority. Let me present a short example to illustrate the major dimensions of this problem. Consider the case of an expert teacher recognized as an authority in a particular subject area who is aware of the content of the School Council's published charter on teaching competencies. Let us suppose she is puzzled by this document because the charter neither reflects her values nor supports the principles she applies in routine class activities. Is she to suspend judgement on her own capabilities, assent to government authority and follow the edicts in the Schools Council document; or does she uphold the principles that have brought her the respect of the colleagues, students and parents?

The conflict is a classic one in the literature on freedom and political philosophy from John Stuart Mill to present day thinkers. Joseph Raz (1985), the Oxford don, claims that such conflicts arise only when governments exceed their authority, especially in respect to the neutrality they should promote in the inevitable conflict of ideas about the good, in this case the good education. It follows that we should be extremely cautious when ascribing particular sets of attributes and personal qualities to expert teachers; in particular in asserting that such sets of attributes should be prescribed as essential to all definitions of expert teaching. The research work I have quoted today is the research based on value systems that promote certain models of teaching in circumscribed subject areas, using particular kinds of curricula in restricted environments.

Let me press the point. In much of what I have said today it might be presumed that I am convinced that we have identified all the attributes and behaviours of expert teachers. I want to dissuade you from such a view. There is no one model of excellence in teaching. Different teaching strategies and different models of expertise have been identified and although they share common characteristics they also demonstrate variability. The ultimate measure of expert teaching is determined by its effects on learning; and learning itself is diverse and multifaceted. We must adopt a liberal tone to our discussion about these matters. Raz (1985) suggests there should be a morality of freedom that dominates our thinking in this area. We are not obliged to prescribe, or dictate, or impress specific methodologies or procedures on others; instead we should encourage every teacher and academic to find the most appropriate methods in each subject area consistent with sound learning.

Finally, I must comment on the university teacher's dilemma, especially as it relates to matters of expertise. C. P. Snow, in his Rede lecture at Cambridge in 1959, said that there were two cultures in universities: one the non-empirical and artistic; the other the empirical and scientific. May I suggest that in this country at this time there is a cultural divide of a different kind: on one side are those who believe that the university role should be in teaching and professional development; on the other are those who claim that research should be the centre of university life.

According to those who support the teaching culture perspective, the aim of the university should be to foster a culture of learning, provide good exposition of subject matter and strive to get students to achieve subject matter mastery that is critical to professional competence and personal development. This kind of culture has a long history in universities and has much to recommend it. Students appreciate the attention given to their needs and if the plaudits given to staff by Edith Cowan University graduates at graduation ceremonies are any guide, this university has much to be proud of in this area.

The other culture is just as appealing, and is well represented elsewhere in this state and to some extent in this university. Primarily the concern is with the culture of research. Those who support this view try to persuade us that real learning in universities is fundamentally controlled by researchers, not teachers. Simply put, this view is that research is more important than teaching and that learning is best achieved in association with a culture of research.

These two cultures are often seen to be in conflict. The conflict is real and if the extremes of these views are expressed too strongly there is a risk that there will be some damage to university traditions. In my view it is better to soften the tone of the debate and adopt realistic perspective: it is inevitable that there will be a concentration on one or the other perspectives in different universities. All universities provide both teaching and research, the mistake is to believe that in doing one we are also doing the other. Expert teaching comes about if the institution and the staff concentrate and develop a culture that promotes it. Likewise, expert research is conducted if the university culture supports it.

This university has a strong commitment to quality teaching and the results are clear for all to see; the aim should be to make it even better. Teaching is a priority in this university and it is a goal that should remain in focus. This university is also developing a research culture, and in time this will gather strength and grow further. The best and most enlightened policy may be to encourage both cultures, but to be realistic and promote the image that best reflects the needs of students and the aspirations of our constituents.

The economists tell us that service industries, including education, are critical to the growth of modern societies. I believe that Edith Cowan University has an unique chance to influence policy decisions in the education professions and services field more than most other universities. We have the potential to make an enormous contribution because of the range and size of our resources and well-established links with schools across the state. One challenge we have set ourselves is to make this university a model for excellence in university teaching; our other challenge is to convince our students in education that the highest standards of teaching is a worthy professional goal.

## References


Bandura, A. (1986). Social foundations of thought and action. Englewood Cliffs: Prentice Hall.

Beazley, K. C. (1993). Teaching Counts: A Ministerial Statement. Department of Employment, Education and Training. Canberra: Australian Government Publishing Service.

Borko, H., & Livingston, C. (1989). Cognition and improvisation: differences in mathematics instruction by expert and novice teachers. American Educational Research Journal, 26(4), 473-498.

Boshuizen, H. P., & Schmidt, H. G. (1992). The role of biomedical knowledge in clinical reasoning by experts, intermediates and novices. Cognitive Science, 16, 153-184.

Chi, M. T. H., Glaser, R., & Farr, M. J. (1988). The nature of expertise. Hillsdale: Lawrence Erlbaum.

Cole, P. G. & Chan, L. K. S. (1993). Teaching principles and practice. Sydney: Prentice-Hall.

Glaser, R., & Chi, M. T. H. (1988). Overview. In M. T. H. Chi, R. Glaser, & Farr, M. J. The nature of expertise. Hillsdale: Lawrence Erlbaum.

Grossman, P. M. (1992). Why models matter: An alternate view of professional growth in teaching. Review of Educational Research, 62 (2), 171-179.

Higher Education Council. (1992). Higher education. Achieving Quality. Canberra: National Board of Employment Education and Training.

Hoy, W. K., & Woolfolk, A. E. (1990). Socialization of student teachers. American Educational Research Journal, 27 (2), 279-300.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. Review of Educational Research, 62 (2), 129-170.

Kennedy, M. M. (1987). Inexact sciences: Professional education and the development of expertise. Review of education, 14, 133 -167.

Leinhardt, G., & Greeno, J. G. (1986). The cognitive skill of teaching. Journal of Educational Psychology, 78 (2), 75-95.

Leinhardt, G. (1989). Math lessons: A contrast of novice and expert competence. Journal of Research in Mathematics Education, 20 (1), 52-75.

Locke, E. A., & Latham, G. P. (1990). A theory of goal setting and task performance. Englewood Cliffs: Prentice-Hall.

Montague, W. E., & Knirk, F. G. (1993). What works in adult instruction: The management, design and delivery of instruction. International Journal of Educational Research, 19 (4), 329-443.

Raz, J. (1985). The morality of freedom. Oxford: Claredon Press.

Schools Council. (1990). Australia's teachers: An agenda for the next decade. A paper prepared by the Schools Council for the National Board of Employment, Education and Training. Canberra: Australian government Publishing Service.

Stallings, J. A. (1986). Effective use of time in secondary reading programs. In J. V. Hoffman (Ed.), Effective teaching of reading: Research and practice. Newark: International Reading Association.

Swanson, H. L., O'Connor, J. E., & Cooney J. B. (1990). An information processing analysis of expert and novice teachers' problem solving. American Educational Research Journal, 27(3), 533-556.