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## EXPERIENCES IN GIFTED EDUCATION: IMPLICATIONS FOR TEACHING STRATEGIES FOR A CLEVER COUNTRY

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### ABSTRACT

In preparation for a workshop at Monash University, where a group of Australian educators were to be involved in writing a book based on their collective wisdom and interest in the fostering of excellence in young people and children in the 1990's, the present writers engaged in a reflective exercise in ascertaining how best to educate our most talented science students. However, in the eventual chapter written by Newhouse *et al.* (in Goodall and Culhane 1991:70), the theme was related to the concept of empowering a whole school community, 'globally' a far cry from the notion of empowering talented students to be competent, creative and autonomous scientists. In the present social climate in Australia, where there is an increasing demand for creative scientists and caring technologists, it would appear to be both appropriate and timely to consider a Science Extension programme in which both writers were engaged in the early eighties. The focus will be a description of the strategy which progressively produced over a three year period, not only efficacy in the student's preparation for research, efficiency and creativity in open ended inquiry in science, but a group of young people who thought reflectively and productively as scientists. In the light of their analysis of the role of the teacher/mentor and the outcomes of the science extension program, the writers will speculate on the implications for teacher education in the 1990's.

### Introduction

The Social Justice Policy and guidelines, published by the Ministry of Education of Western Australia in 1991

*endorsed the view that students should have their gifts and talents extended and considered that this is a major responsibility of schools.*

Edith Cowan University is one of the few tertiary institutions in Australia where both pre-service and post-service units in gifted education are firmly instituted in the education programme of the present Faculty of Education. This strong

emphasis on catering for special needs of children and adolescents was inherited from the collective interest of lecturers at the four colleges of education that amalgamated in 1984 and was later granted university status in 1991. The expertise and enthusiasm of the lecturers in this area of Gifted Education has been enhanced by their willingness to be involved in action research in both primary and secondary schools over the past fifteen years.

The writer of this paper was privileged to share and advise in the planning, implementation and evaluation of a school based extension programme for the gifted at a high school in Perth. It therefore seems appropriate in the present wave of encouraging excellence in an economic recession, to reflect on an effective approach for the education of gifted students which was relatively inexpensive and had positive percolating effects on the quality of learning for students, also taught by the teachers of the gifted, in the traditional programme.

The action research at Rossmoyne Senior High School between 1979 and 1984 was a time of growth for both students and teachers involved. For the teachers it was a time of reassessment of their traditional teaching styles and strategies, not only for the most gifted and talented, but also for other students in the school. The programme was a whole school approach to gifted education, with an emphasis on extension from the 'traditional' programme (Jones and Newhouse 1982:16), where gifted students were encouraged in every field of endeavour (Jones and Newhouse 1981, 1982 and 1984). One such field was that of science, where the students were to be primarily involved in interest-based inquiry (Washbourne 1982:20). A theoretical framework devised by Brown and Campione (1981) was adopted in the Science programme, where the focus was essentially on the learner and his/her effective learning. Thus there was an emphasis on the process of scientific inquiry and a careful evaluation of the most talented students' methods of learning, skill development, processes of thinking, growing competence and confidence. The students were under the mentorship of Mal Washbourne, the science master; and Lesley

Newhouse, as the Programme Consultant, provided both input and skills as a participant observer. Generally, the authors believed that though these students were 'extremely bright' and capable of organising themselves during extension science classes, they required formal training in scientific inquiry. Secondly, even though they were 'highly intrinsically motivated' they required a mentor and a written contract to achieve their goals. As a consequence of two successive yearly evaluations, we were encouraged to look at years 8, 9, 10 as a progressive whole towards nurturing a spirit of scientific inquiry through developing laboratory skills, thinking skills and introducing a contract system that was the embodiment of research study preparation and scientific procedure.

### Year 8 - The Training-Apply Year

The first term of extension science in high school was devoted to facilitating the acquisition of practical laboratory skills and reflective thinking. In terms 2 and 3 the aim was to further develop the expertise of the novice scientist by emulating the procedures of scientific inquiry used by the expert scientist. The year culminated in planning, contracting and completing a minor science project or experiment.

#### Term 1 - Skills Phase

The choice of content was more restricted during Year 8 and more emphasis, particularly in Term 1, given to accelerating the student through practical scientific techniques. Students were also schooled in metacognitive strategies to facilitate personal reflection on their processes of thinking (Feuerstein, 1978; Flavell, 1979).

#### Terms 2 and 3 - The Exploratory Phase

Students were encouraged to select minor projects or experiments that required careful pre-planning and to assist in this they were introduced to 'the contract system', which encompassed the essence of the research process (Newhouse and Washbourne 1982:23). The contract enabled the students to produce a creative plan and the steps taken reflected the scientific method. Furthermore, the students were able to perceive gaps in the knowledge and skills they needed to master to accomplish their research. By the end of the first year, the students were well-versed in the nuances of pre-planning a research project; using library skills of search and review of the literature, originally developed through the co-operative efforts of the Teacher

Librarians; and knowing where to go to acquire skills and competencies that could enhance their research project. In terms of affectivity, the students also began to 'feel like scientists' as evidenced by their commitment to the task.

### Year 9 - Shift of Locus of Control to the Student

The gifted science students in Year 9 were deliberately forced to shift their locus of control from the mentor to themselves. As a result they became more autonomous in their choice of scientific topic, though the contract system was firmly adhered to. This provided a 'project pathway' which enabled all students to plan, monitor and check their knowledge, skills and attitudes. This infrastructure enabled them to pursue their favoured scientific inquiry in a more relaxed, creative and fulfilling way. It also provided students with a formative evaluative check on their progress, a key to the next stage of the project and the skills required. For example, one group of students, involved in a Chick Embryology Project, required photographic skills to record the stages in embryonic development of the chick and these were acquired with the help of the Manual Arts teacher. In terms of affectivity, there was increased sensitivity by the students, as 'scientists' committed to the task. In the same project, students devised a roster system over the weekend to care for the needs of the chicks during the hatching phase. Confidence in their capabilities was further enhanced by entering science competitions where their completed scientific projects came under the close scrutiny of experts in the field.

### Year 10 - Further along the pathway from novice to "expert" student scientist

Knowledge, skills and research techniques were consolidated in Year 10 and students completed enterprising and varied research projects, several receiving public accolades. For example, one student's project on plant cloning earned a 'berth' on space shuttle.

### Mentorship - Its crucial role in the science extension programme

The mentorship of the science master was crucial to the process of 'becoming a self-actualising scientist'. He developed such a close working relationship with the students that some were comfortably on first name terms. His role was essentially that of facilitator, firmly and deliberately placing 'the locus of control' of learning into the hands of the student. He

encouraged this growing autonomy for learning by:

a. *Adopting a sounding board role for their own ideas.*

For example, Ricardo, a Year 9 student, was engaged in plant cloning and required a sterile environment for his plants. As a result of interaction with his mentor, who used listening and questioning skills to help clarify his ideas, Ricardo, by logical reasoning, discovered the way it had to be done. In this case he built his own apparatus using the expertise of the Industrial Arts teacher.

b. *Using the instructional role judiciously*

Content input was limited to the science teacher's own area of academic expertise. This, the writers believed, was critical to the students' perception of him as facilitator of their learning and not the universal expert. Mentors, expert in the student's area of interest, were sought to provide input when required and to be a source of encouragement. For example, Ricardo was mentored by a geneticist at Murdoch University. The role of resource person and community expert became crucial to this belief.

c. *Being perceived by students as a resource person*

This was crucial, both in terms of acquiring the help of human resources, (who were experts in the student's special field of inquiry and those who assisted in acquisition of skills) and material resources, as students sought the satisfaction of their research needs. The overall gifted extension program co-ordinator was an invaluable supporter of this role for all extension students. The lack of funding for resources actually encouraged students to improvise and make their own apparatus from cheaper materials and parts. (For example, the sterile unit for plant cloning was created by the student with the help of the Industrial Arts teacher).

d. *Encouraging the students to question the traditional boundaries that exist in the scientific paradigm*

The teacher encouraged the reading of science fiction as a trigger for 'future studies' and an example to follow in the realm of speculation. Integration of subject disciplines and the thematic organisation of content had begun to

take root as a way of enhancing the creativity of the science students. (For example, the integration of literature and science.)

e. *Actively encouraging creative ideas and modelling the creative scientist*

This required the teacher also to be creative and open to the new ideas of his/her students. A preparedness to listen with an open mind was essential. For example, students working on a water project related to the environmental conditions, were prompted to contemplate on the viability of a water wheel in a fast moving part of the stream. They pursued this side-issue on a way of improving the environment with their teacher mentor for some time. It was interesting to note at this time that the Mentor was himself pursuing a Master's degree related to information processing and effective problem solving (Washbourne 1984).

f. *Assuming the shared role of evaluator to encourage responsibility for learning by the students*

The students by the very nature of their contracts became confident, competent and realistic evaluators of their own work. The teacher, as mentor, encouraged good scientific and research techniques to fulfil the criterial task during the formative evaluation phase. Summative evaluation was principally the role of the expert in the field (who may or may not be the teacher) and was often subject to public scrutiny when entered in Science competitions. The latter form of evaluation is very important in preparation for adulthood and in their ability to accept constructive criticism.

**Evaluation of the Science Extension Programme - some unresolved issues**

In 1984, as part of The Commonwealth Schools Commission 'Projects of National Significance', Rossmoyne Senior High School produced a comprehensive evaluation of their Extension Programme for the Gifted (Jones and Newhouse 1984). It was clear at this stage that the gifted students in science had progressed so well in both scientific technique and problem solving capabilities that the traditional programme was becoming for them an irrelevant and uninspired hurdle they had to jump. This dilemma remained unresolved though it was voiced on the video accompanying the written evaluation

report. One suggestion was total withdrawal of potentially gifted science students, where the science master could keep a checklist of the 'traditional' science content and carefully record each students' acquisition of essential basic scientific knowledge and skills over the three years. The perennial problem in science still exists in the 1990's, namely, the knowledge explosion in science, and whether all students should 'know' everything or whether our most gifted should follow the contentious path of developing skills of scientific inquiry in specific areas of interest, together with a reflection on the efficacy of their thinking capabilities. If the latter path is to be taken it requires a gifted teacher to provide 'traditional' content knowledge both to the individual student and at appropriate times to the whole group.

**What Next? - In terms of strategies for a clever country and teacher education in the 1990's**

The students selected for the programme for the gifted scientist at Rossmoyne Senior High School were the high achievers in the 'traditional programme'. From this reflective paper, the writers confidently concluded that the high achievers selected from the 'traditional programme' were able to be lead into autonomous creative scientific pursuits by acknowledging that:

1. The curriculum planners required a theoretical framework that was the very antithesis of the way student teachers were traditionally educated. In short, to no longer assume that teaching and learning are necessarily synonymous (Print 1989:65).
2. Students of all ages 'learn by doing' best, but they need the 'learn to learn' skills to be able to achieve that effectively.
3. The 'locus of control' for the learning should be deliberately given to the student over time. It is salutary to note that current teaching practices in schools generally prevent the shift of 'locus of control' to the student.
4. Once they have acquired 2. and 3. it should be the student's responsibility to select an area of interest, then plan, act and write up the research under the mentorship of the teacher, primarily, with the help of other expert mentors within and outside the school.

5. Teachers need to be educated to fulfil this multi-faceted role effectively. There is already a vision of alternative approaches for teacher education, but little comprehensive implementation.

**Implications of this action research for all learners and teacher education**

We believe that the outcomes of our action research with extension science students at Rossmoyne Senior High School are equally applicable to all students in any field of endeavour. Recent research by Borkowski (1985) and Carr and Borkowski (1987) focuses on information processing and the value of metacognition for improving thinking and learning. Biggs (1985) focuses on 'deep learning' and the limitations of traditional schooling in promoting student autonomy and control of his/her own learning. This research focuses on the learner and as such, can provide a theoretical framework to substantiate the practice of leading students of all ages into autonomous creative learning (for example, Rossmoyne Extension Science students). Strategies of effective information processing; metacognitive strategies; planning for action, production and self-evaluation skills; in addition to feelings of confidence and competence, and the thrill of discovery at every level, may be fostered by the teacher, who is specifically educated in facilitating these skills. Teacher education, which focussed on these strategies, would have a profound effect, not only on the education of our most gifted students, but also on the total school population. 'Teaching strategies for a Clever Country' still requires much debate at all levels of the education system in Australia. Certainly, we need to look more closely at teacher education not only in terms of the content, skills and processes but to envisage the multi-faceted qualities of teachers required for schools of the 1990's. Could it be that the programme for extension science students might provide an effective template for the education of teachers for a clever country? Is it time to go back to the philosophy of John Dewey (1916) and its relationship to the current thinking of Sargent (1981), Reid (1986), Dalton (1985), Clark (1988), Giroux (1988) and Randall (1989)?

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## REVIEW ARTICLE

## HOW CAN WE KNOW ABOUT KNOWING IN EDUCATIONAL ADMINISTRATION?

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Colin W. Evers & Gabriele Lakomski (1991) *Knowing Educational Administration* Pergamon Press, 250 pp hdbk, c. A\$85

This book is subtitled "Contemporary Methodological Controversies in Educational Administration Research". We are here not talking about educational administration as such, but about theories of educational administration, and at a level of abstraction which many administrators will find daunting. In describing prevailing controversies over epistemologies in educational administration, the authors present yet another one, namely whether their Quinean/holistic point of view can accommodate ethics and a rational knowledge without a foundational justification as flawed as the ones they criticise.

Many of the chapters had appeared in discrete form by the two authors in international journals. They have been pulled together here skilfully and coherently. One cannot dispute the scholarly presentation of material. Educational administrators such as Griffiths, Greenfield, Hodgkinson, Hoy, Willower, Sergiovanni, Kemmis, Bates are discussed in some detail. Because their administrative policies are secondary to a pursuit of their epistemological assumptions, a prior knowledge of their work makes following the argument much easier. Writings from Dewey, Taylor, Simon, Gadamer, Habermas, Giddens, Churchlands provide a broader post-positivistic epistemological context to their argument.

The authors begin from the assumption that "Promoting good rationality is... a matter of promoting the kind of reasoning employed in and exhibited by 'our best theories'" (p. 183). What counts as 'best'? "We believe that the mistake lies with the epistemological enterprise of foundational justification... Foundational justification proceeds typically by identifying an epistemically privileged set of claims and then attempting to use these to justify other claims." (p. 213).

Most of the educational administration theorists discussed in this book are defined as holding one of two types of foundationalist theories. Firstly, the *oppositional diversity thesis* is held by those who claim that research paradigms are incommensurable. "The scientists who live in different paradigms live in different worlds". Popkewitz (1984, p. 35) for example divides educational sciences into the three paradigms - empirical analytic (quantitative), symbolic (qualitative and interpretive) and critical (where political criteria are applied). Burrell and Morgan's (1982, p. 217) interpretive, functionalist, radical structuralist and radical humanist paradigms illustrate another four mutually exclusive sets of basic assumptions about the way research relates to the world. Qualitative (action research) is seen as incommensurable with quantitative models, because of their different goals - social improvement or validity.

The second is a *complementary diversity thesis* which acknowledges that even the incommensurable paradigms used by Kuhn, Newtonian physics and quantum theory, continue to be used side by side in current scientific research. They are simply acknowledged to be serving different human purposes. This *methodological pluralism* allows for appropriate ways of approaching different, or even the same, research problems and supports. Folk theories can coexist happily with meta-analysis and behavioural science regardless of their different epistemological assumptions. The problem of how they can resolve their differences, or even if they need to, is left unanswered. Evers and Lakomski are content to avoid detailed discussion as to how Giddens can maintain the explanation/understanding distinction, for instance, simply referring (p. 225) to an unpublished 1987 paper by Jim Walker. In admitting the problem of unambiguously identifying educational research paradigms, they raise the question of how their own coherent theory can be placed outside a complementary diversity thesis. One of their main problems is the self-reference necessary to pursue a more