Innovation and Implementation
Stories of Success

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Greg James completed a Bachelor of Science degree with a major in Mathematics and Honours in Chemistry from 1981 to 1984. He then completed a one year Diploma in Education course and since then he has been a full time Mathematics teacher. In 1992 he went on exchange to Britain as Acting Head of Mathematics and Science at Bellingham Middle School, in the country of Northumberland. The rest of the period from 1986 to 1994 he spent at Smithton High School, taking a major leadership role in Mathematics as part of his AST1 responsibilities in the later years. Since the start of Term 2, 1995 he has been at Prospect High School as an AST3. He now has a different set of leadership roles, but one of these still involves curriculum development in Mathematics.

Robert Phillips is is currently the manager of the Department of Education and the Arts (Tasmania), Programs Implementation section. The members of this section work directly with teachers in implementing Departmental priorities and policies. Prior to this, he held the position of Principal Curriculum Officer (Science), working with schools K - 12 throughout the state. His areas of particular interest are learning, change and learning organisation theories and their implications for practice.

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Science, Maths and Technology Education. Currently he is working with Prof Phillip Hughes and Assoc Prof Joan Abbot-Chapman to examine teacher competencies as part of a ARC Large Grant. He is a Fellow of the Australian Teacher Education Association and co-edited the South Pacific Journal of Teacher Education for six years.

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An Overview of the OECD Science, Maths and Technology Education Project

John Williamson

project context

The OECD Project

This Tasmanian project was conducted as part of a larger OECD study to investigate Science, Maths and Technology Education innovations in schools. For the last two decades the study of education and, in particular, teachers have been noticeable features of the OECD's range of research interests. Studies have investigated teachers' work, training and conditions of service as part of a concern among member countries to improve and sustain teacher quality, as indicated in a recent report:

> However, the key to quality education and necessary education reform lies not with reform strategies, but with individual teachers in the classroom. Teachers will play the central role in improving educational standards and opportunities in our schools in the years ahead. (NSW Ministry of Education, 1990)

What are the factors that provide the context for this central role of teachers? There are at least three clusters of interrelated factors which can be identified. The first of these is an economic cluster usually expressed by politicians and business leaders who are concerned to stress the need to improve a nation's economic performance. The second is the broad community social concern about the quality of

schooling. A quick glance at the media shows that in the public expectations of schools there is some gap between the current practice and what the community says it wants. Finally, the third cluster relates to the rapidly changing and dynamic society that schools and teachers now face. This cluster involves dimensions such as multiculturalism, new technologies, and changes in cultural and individual values.

In this situation, major issues relating to teacher quality and policies which support and promote it in the Australian context have been described elsewhere (Williamson, 1994). It is enough to note that these elements include:
educational policies, such as curriculum guidelines and strategies aimed at changes in decision-making, which have direct consequences for the teacher's role and work;
local-level policies and implementation strategies that influence the levels of responsibility for, support of and direction of the work of teachers in schools;
the organisation and culture of the school, which are seen as effecting student achievement and teacher satisfaction; and
the links between classroom and school management, including collaboration between teachers and the implementation of school wide innovations.

Any consideration of teachers' professional lives soon leads to the issue of innovation: its nature, development and implementation. Certainly there is a theme in most recent educational research and innovation which accepts the intimate relationship between curriculum and pedagogy.

It was in this context that the OECD undertook an international study involving 13 countries, including: Australia, Austria, France, Germany, Ireland, Japan, Netherlands, Norway, Scotland, Switzerland and the United States, to explore issues relating to Science, Maths and Technology Education innovation in schools. The project commenced in 1993 and will conclude in 1996 with the submission of a report to the Governing Board of the Centre for Educational Research and Innovation at the OECD in Paris.

To provide a framework that allowed for cross-country comparisons the project Steering Committee proposed a common structure for the reports. Project directors, for example, were asked to ensure there were (a) narrative components to describe the innovations and provide some background to it and, (b) components which related to evidence, analysis and interpretation. These included methodological details, perceptions from teachers and students and reflections on the main lessons or themes in the study.

The Project Director was invited to participate in the project and conduct the Australian case study. A request to the Tasmanian Department of Education and the Arts for access to schools involved in Science, Maths and Technology education innovation was granted readily. The material presented here not only shows schools and their communities working together as never before, it also allows the lighthouse work of Tasmanian educational innovations to be placed in an international context.

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Methodology of the OECD Science, Maths and Technology Education (SMTE) Project

Trudy Cowley

The OECD guidelines for the SMTE Project suggested the use of case studies to investigate and describe innovations in Science, Maths and Technology Education in schools and education systems. This approach was adopted for the Australian contribution to the OECD SMTE Project. The aim of the case studies was to describe and illuminate innovations occurring within Tasmanian schools in each of the areas of Science, Maths and Technology Education.

SCHOOLS INVOLVED

The Project Director, Professor John Williamson, negotiated selection of and access to the schools and colleges with senior Department of Education and the Arts (DEA) officials. The DEA staff, principally the Principal Curriculum Officers for each of the areas of Science, Maths and Technology Education, suggested 14 government schools/colleges which they identified as being innovative in pedagogy, curricula and/or staff development. At least one school was chosen from each of the subject areas, at each level of schooling (ie primary, secondary and college). The Project Director contacted all schools/colleges nominated and ten agreed to participate, one for two subject areas. Table 2.1 shows the curriculum area and the nature of each of the participating schools/colleges.

Table 2.1.Curriculum Area, Location and Level of Participating Schools/Colleges

Curriculum Area	Participating Schools/Colleges	Location
Science (n=4)	Exeter Primary School	
	Lilydale District High School	
	Cosgrove High School	

Launceston College
Rural
Rural
Urban
Urban

Maths
(n=3)
Claremont Primary School
Smithton High School (7-12)
Elizabeth College
Urban
Rural
Urban

Technology
(n=4)
Lauderdale Primary School

Penguin High School
Reece High School
Elizabeth College
Urban
Rural
Urban
Urban

Research Team
The research team consisted of 17 persons, both academics and research assistants. In addition, support for the project was given by personnel at the DEA.

Eight academics, including the Project Director and the Project Executive Officer, were involved in the project. Each of the three curriculum areas had two academic staff involved in data gathering, analysis and writing of initial case study reports. The Project Director was responsible for overseeing the smooth running of the project and assisted with writing the final reports. The Project Executive Officer was responsible for coordinating the work of the other academic researchers and research assistants. She was also responsible for liaison with the Department of Education and the Arts (DEA) and final report writing (with the Project Director).

The Project Director made available a research assistant to each of the case study schools for data collection. The research assistants were selected because of their knowledge of the particular curriculum area for their assigned school, and the various data gathering approaches to be used in the case studies. These were outlined to research

assistants at a meeting prior to data collection. At this meeting, research assistants were familiarised with the data collection instruments and given the opportunity to discuss and standardise their data gathering approaches.

DATA GATHERING: APPROACHES AND ANALYSIS

Each research assistant spent a minimum of four weeks in his/her school or college; the typical time was around five weeks. The first week in the school or college was used solely to become acclimatised to the school; its operation, students, staff and the innovation. The data were subsequently gathered in weeks which were split over Term 3 of 1994 and Term 1 of 1995.

It was emphasised to all project members that the aim of the study was to describe what was going on regarding the innovation and not to evaluate it. Methods of gathering data included the following:

(1)Observations of classes and staff meetings in action. Written notes were taken where necessary.

(2)Interviews using a semi-structured format with teachers, students and senior staff. The interviews were tape-recorded, but not all were transcribed. Some of the interviews were conducted in group mode, but the majority were one-to-one on a face-to-face basis (refer to Appendix A for interview schedules). A slightly different interview schedule was used for each Key Learning Area: Science, Mathematics and Technology. These interview schedules were only guidelines and Research Assistants were free to adapt these as they saw fit dependent upon the context of the interview and the innovation.

(3)Collection of documents which related to the innovation (refer to Appendix B for a list of documents for analysis). These were later analysed.

(4)Journals completed by the students at the end of a lesson (refer to Appendix C for journal outlines). The student journals, with slight variations for each subject area, were given to the Research Assistants as an aid to data collection. These were used at all schools and colleges except Reece High School. Several Research Assistants varied the format of the journals to suit the students and the context of the innovation at their school. These variations did not change the general focus of the student journals.

An academic from the relevant curriculum area worked with a Research Assistant to analyse the data and materials collected from each case study school or college. The teams were requested to provide a case study report which was structured around broad themes identified in the OECD guidelines. In several instances the teams were asked by the Project Executive Officer to restructure their report to conform to the suggested guidelines.

Each of the draft case studies was sent to the relevant school or college for comment and feedback. A covering letter from the Project

Executive Officer invited them to correct any errors of fact and to amend any statement with which they disagreed. The schools or colleges were asked to liaise with their respective Research Assistant or the Project Executive Officer regarding any feedback they had to give.

The next version of the case study report for each school was written to include feedback from the schools/colleges and the Project Executive Officer. Copies of these reports were submitted to the schools and, in some cases, further feedback was received and included in the final report when they were restructured to include OECD feedback. The OECD, after reviewing the national reports from all countries, asked us to use a slightly different structure for the report from the broad themes first suggested.

LIMITATIONS & ADVANTAGES OF THE STUDY/METHODOLOGY

There were several limitations to this study. Most of them were due to constraints of time and finance. As the study was part of a larger OECD Project, the deadlines for reports, etc were pertinent to a northern hemisphere school system. Some of the limitations to the study are listed below.

(1)The conduct of the research was split over the summer holidays between the 1994 and 1995 school years. This meant that much of the data collection was occurring when schools were either winding down or winding up.

(2)The schools/colleges were not selected randomly, but were nominated by DEA officials as lighthouse schools in the areas of Science, Maths or Technology Education. Thus, it was not possible to generalise the findings to the rest of the Tasmanian (and Australian) school and education systems.

(3)There was a somewhat narrow focus on issues connected with the innovation (eg no direct attention was given to 'assessment') because of time and project personnel constraints.

(4)The case studies only gave a snapshot view of each innovation which did not allow for generalisation across schools or into the future. Therefore, we were unable to follow, in a longitudinal way, the innovations for an extended time. Consequently, we could not tell if the innovations became integrated into the school culture, changed course, or fizzled out.

(5)Because of the reliance on Tasmanian government schools, there was an inability to generalise directly to other Australian states and territories from the specific Tasmanian situation and to other school systems.

(6)The Research Assistants took slightly different approaches in collecting the data in the schools/colleges. This resulted in case study reports of varying length and detail.

(7)A certain amount of the interview data recorded on tape could not be transcribed due to time and financial constraints. However, some of the information on the tapes was recorded in written form during the

interviews.

These types of limitations are not unusual in this kind of research where many researchers were involved, the time frame was limited, resources were limited, the research was localised, and the research was part of a larger international project. There were several advantages regarding the methodology of this project. They included:
(1)The case study reports described exemplary practices in schools at a time when education 'copped a bashing' from all quarters.
(2)The use of several Research Assistants provided uniqueness and different perspectives for the writing of the case study reports.
(3)The case study reports told stories which were personalised by quotes from both students and teachers.
(4) The amount of time the Research Assistants spent in the schools/colleges meant they could write their respective reports from an insider perspective. They each had time to absorb the school culture.
(5)As Research Assistants were in the schools for several weeks, they could be sure the innovations they saw were authentic.

Moving Ahead in Science Teaching at Exeter Primary School

Marie Gavlick

THE CONTEXT

Exeter Primary School lies in the Tamar Valley and is situated 24 kilometres north from the city of Launceston. It has an enrolment of approximately 670 children from kindergarten to grade 6. The school serves the township of Exeter and the surrounding rural area with over 90 percent of the children being bussed in from the countryside each day.

There are some 30 teaching staff with 10 support staff serving the children who come from a variety of socio-economic backgrounds. Previously the school was an Area School with secondary classes. Ten years ago a separate high school was built for secondary students. Recently, Exeter Primary has undergone building redevelopment resulting in attractive, pleasant, purpose designed facilities for primary level education.

The staff at Exeter Primary School, whilst large, is a purposeful and harmonious group. Children, teachers and parents work towards the achievement of worthwhile agreed goals. High self esteem features in the school. Each participant is valued for his/her contribution. A pursuit of excellence underpins all curriculum areas: Literacy, Numeracy, The Arts, Problem Solving and Relationship Skills. The schools' curriculum is becoming increasingly refined and staff development programs have resulted in a highly motivated team, committed to the school and its ethos.

A great deal of progress has been made in most recent years in helping teachers to cope with self management and the increased workload. Teachers are now required to have an active part in budgetting and production of the School Plan and they attend numerous meetings in order to drive the School Plan. Many have the added responsibility to organise and often conduct professional development for their colleagues. All of this is in addition to a normal teaching load. Whilst these responsibilities are time consuming there is a feeling among staff of ownership of the School Plan and a chance for genuine

input. Support staff also are encouraged to take part in decision making and are valued equally for their contributions. Aides, part time staff and more regular teachers are encouraged to participate in curriculum, professional development and workshop activities which are of interest to them.

Parent and community involvement is a significant feature of the school. Education has always been highly valued in the West Tamar and this strong theme is a dominant force in the life of the school. Along with this there is an emphasis on academic achievement. Parents are visible at Exeter Primary School and an open door policy exists at the school. Parents are constant participants in the school program and most classes, particularly K-4, have more than a dozen parents who work regularly in classrooms. Parents attend professional development activities, particularly in our priority areas. Parent forums are organised on a regular basis on topics chosen by the parents themselves. Workshops and seminars are also conducted for parents parallel to the major professional development provided for staff.

In developing the School Plan for 1992, the staff expressed a concern at the quality of Science teaching in the school. Teachers recognised Science as an area of neglect. Numeracy and Literacy were highly developed and operating well. The emergence of National Statement and Curriculum Profiles in Science (AEC, 1994a; AEC, 1994b)), along with Science being listed as a Tasmanian system priority for 1993/94, moved teachers to nominate Science as a priority area for 1993 at Exeter.

Areas of concern included storage of materials, requests for unit boxes, additional equipment and the need for professional development. The Science Group of four teachers met in October 1992 to plan for 1993. They had been working for some time on the purchases of resources, books and charts suitable for K-6. A level of interest had grown at Exeter in participating in the Science Talent Search and the group reported more teacher interest in Science based class activities. A budget was prepared to meet some of these needs.

Organisation of staffing much later in the year of 1992 somewhat changed the directions of the Science Group in the school. When

staffing for 1993 was discussed, teachers raised the issue of a Science Reource Teacher. In a school which was already staffed with three specialists this was a big undertaking. Teachers agreed to have larger numbers in classes so that this specialist area could be offered. It was felt that this move would give Science a high profile and the concerns raised could be addressed.

With my appointment to the senior staff team with 0.6 teaching load it was decided to make my teaching component Specialist Science Resource Teacher. When I was first approached I was rather daunted by the task but excited by the challenge and agreed to head the program. The action plan prepared in October 1992 did not reflect the change of events so some negotiation was required. As a member of the senior staff team I was positioned well to request the extra funding required.

In essence, Exeter Primary School needed a new Science curriculum K-6. This curriculum was to reflect the National Statement and Curriculum Profiles (AEC, 1994a; AEC, 1994b), the Tasmanian Department of Education and the Arts' Frameworks K-12 (DEA, 1993) and at the same time relate to the interests and needs of the whole school community. My major leadership task for 1993 was to plan a professional development program for Science teaching. A group of teachers was required to develop, during the year, policy, a curriculum broadsheet and unit resources ready for implementation in 1994 and 1995.

Coming to terms with my role in the school was demanding and a great deal was expected of me. Newly appointed to the school in a senior staff position I was required to:
deliver the Science curriculum 16 hours per week K-6;
provide leadership in organisation of resources;
develop a professional development program for the staff, assist the Science Group to reflect on practices and produce a Science Curriculum Broadsheet; and
achieve a high profile for Science in the whole school community.

It is important to remember that it was also necessary for me to carry out additional leadership tasks in the school organisation and management.

SETTING THINGS IN MOTION

In planning an appropriate program it was necessary for me to focus not only on Science teaching in general but teaching and learning practices in particular which underpinned all that we do in the educational program at Exeter. In addition, personal reflection was appropriate in first identifying factors influencing adult learning and the leadership strategies I planned to use to bring about change in Science teaching and learning.

My preliminary school holiday planning was focussed on the delivery of Science lessons, setting up of the Science Room, collecting materials from around the school and organising them in an orderly way. I managed to acquire the necessary tote trolleys, boxes, work tables, shelving and work benches, all of which were needed to cater for children from all grades. The provision of an attractive and appropriate learning environment was a major aim. I had a great time mending the skeleton (his skull and jaw were broken), organising repair of the microscopes, sorting materials into boxes and arranging the physical environment. The classroom set up included provision for a technology area, tinkering table, wet area, work tables, conferencing space and a display area. Luckily the Science Room was located in an old part of the school which had been refurbished. The three room building featured walk through learning areas with Music at one end and Science the other. The room in between was shared according to the activities at the time. It was not unusual during any teaching session for Music students and Science students to be occupying the middle room. A lovely atmosphere developed and each of us was able to have peace or privacy by closing doors. The time-frame to establish the initial learning environment was three weeks.

My task was destined to change in a number of ways after taking up my position in 1993. It had been my understanding in initial discussions with the Principal that I was to include teachers in my daily Science teaching and I imagined a process by which the two of us would team and work with the children. In this way, I would be modelling good science teaching practices and at the same time team teaching for the benefit of students' learning outcomes.

Quite quickly it became clear that the teachers had a completely different understanding. They viewed my role as a Specialist Science Resource Teacher providing non-contact time. They expected their professional development to come in the usual form at staff meetings, workshops and activity days. To begin with, I was left with no alternative but to work this way even though the team teaching idea was so beneficial to all.

On that basis, I revisited my plan realising that if I presented an

exciting Science program which the children really enjoyed; talked about, looked forward to and from which they advanced their skills, knowledge and attitudes, teachers would be impressed and be more likely to show interest in what was happening.

My own little stand for justice was a reluctance to collect and deliver children. I requested that teachers took responsibility for this task. Because they are hard working, committed people many stayed for 5 or 10 minutes at least before disappearing, returning sometimes for the last 10 minutes of the session. This was a small, but important, step

in the right direction.

The rapid development of the Science curriculum at Exeter Primary School must be viewed in the context of an environment where the curriculum underwent a metamorphosis. Planning curriculum development and professional development has evolved at Exeter Primary School since the introduction of self management in the school. The school staff has changed slowly over that period of time with a nucleus of teachers remaining. Senior staff appointments had been slow with a substantive group in place for the first time in 1993. In addition to the Science priority, the school staff was also investigating the notion of 'Best Practices in Teaching' and teachers had an opportunity to reflect upon their own knowledge, beliefs, values and assumptions.

Working through the 'Best Practices' was an extremely interesting experience, particularly in light of the clear message that was being presented. A great deal of knowledge and expertise has been gained in recent years about teaching and learning and improving the quality of student outcomes and teachers were anxious to explore the ideas in a meaningful way.

It was the discussion of current learning theories which caused many teachers at Exeter to examine their own beliefs particularly the notion of constructivism, which is based on every learner building on previous learning. Our Children The Future (DEA, 1991), the Department of Education and the Arts' blueprint for Primary Education clearly stated that it is the role of the teacher to engage the learner in order to make the links across individually defined constructs or indeed identified fields of inquiry. The teacher achieves this by helping children to question, challenge, demonstrate, explain, collaborate, cooperate, share ideas and give feedback. The learner has a responsibility to consider the questions:
What did I think?
What do I think now?
What for the future?

Some teachers did not feel at ease in dealing with the realities of these ideas. Change can be uncomfortable and people felt insecure thus resulting in a tendency to cling to what they know and working in the ways in which they had always worked.

The experience of staff brainstorming beliefs about teaching and learning was very valuable and enabled us to explore our own ideas and at the same time lay them out for comment by others. I have yet to work with a group of teachers who have not differed in some aspects of their educational platform and what constitutes good practice. As I listened to and participated in the discussion it occurred to me that the articulation of our teaching and learning practice very much reflects our underlying beliefs.

The search for common goals and practice helps teachers clarify their underlying purposes, intentions and motivation for teaching, whether or not teaching is narrowly defined to include teachers and other participants in the school enterprise. Through this exploration it became clear that many teachers, despite genuine effort, have failed to transfer what they know about teaching and learning as components of their Science teaching practice.

With fresh emphasis on Science and Technology many teachers feel inadequate in presenting Science experiences to children. A common concern amongst teachers is their feelings of incompetence in answering children's 'why' questions of Science. Teachers often have good ideas about interesting topics. They prepare and plan well, but they have self doubts about their knowledge about Science. Some teachers avoid Science altogether or use chalk and talk: methods which prevents the necessary interaction between teachers and students. Such examples of Science teaching define the conventional wisdom which tells us that people revert back to known, older models of teaching when under pressure. Teachers can't be expected to be the source of all knowledge. Children usually want a simple clear explanation, they don't so much want to know 'why' but more 'how'.

Some fundamental principles are clear. Primary teachers need to revise the content beforehand. When questions are too curly they make starting points for children and their teacher to work together to pose questions and seek answers.

Issues most commonly raised as blockers are:
lack of time and equipment;
lack of support;
inadequate teacher training;
poor planning and resources; and
inadequate implementation strategies.

It seems that the challenge of the classroom teacher is to strive to improve individual practice and try to understand the meaning of teaching and learning through Science. Teachers need support in this process in terms of resources, time, professional development and encouragement. Both teachers and students need to identify progress that they are making and feel that their achievements are being valued.

PLANNING FOR PROFESSIONAL DEVELOPMENT

The implications for professional development planners like myself are clear. Teachers need to be helped to acquire the necessary knowledge and skills required in conducting a Science program. Planning opportunities should be provided to allow teachers to work together experiencing hands-on activities, discussing key questions, visiting other teachers and classrooms, in order to stimulate thinking on

aspects of effective Science teaching.

Getting together a Science Group was an exercise requiring a great deal of thought and an important strategy in making Science a high profile learning area in the school. Many teachers were members of at least one group and often more. In general the main priority areas varied according to personal interests of teachers. There was a small overlap where the more exemplary teachers were members of two groups or more.

One teacher remained from the Science Group of 1992 and together we had the opportunity to select a new group. There were a number of ways to go about selecting the group, the first being to call for volunteers but I decided against this approach. At this point in time there was no rush to form the group. The action plan was in place and the budget available for use. As a new member of the school staff I was busy getting to know my fellow teachers and 'the way things are done at

Exeter'. So I patiently observed and learned and gained a great deal of insight into staff dynamics. I attended meetings and other program groups, spent time in classrooms and discussed issues with my senior staff team. The time was well spent and by mid-March I had approached a group of six teachers who agreed to form the Science Group.

During April, Exeter Primary School was approached by Mr Bob Phillips, Principal Curriculum Officer - Science, on the recommendation of Macquarie District Office, to consider taking part in the Key Teachers in Science Program; a three year commitment in developing and sharing Science expertise in the district. The key teachers idea was devised as part of the activities of the developing K-12 program.

The emphasis of the program was to work with volunteer or nominated key teachers in nominated schools with the aims of assisting them to be comfortable in sharing their Science teaching practice and approaches. After considerable discussion with the Principal it was agreed that the school would take part in the program. We realised that participation would assist us in achieving our goals in the short term as well as providing the opportunity for sharing with other schools in the district, in the long term. An amount of funding was provided by the Department of Education and the Arts for relief and resources and together with the existing budget we were far more financial. I became aware of a small amount of available money and was successful in preparing a submission which increased the budget to a much more workable amount.

A suggested outline of workshops for the Key Teachers in Science Group (also known as the Science Group) was presented by Bob Phillips outlining the program and providing information. We posed the following questions for consideration:
What are the issues in teaching Science at Exeter?

What are the difficulties?
What should we focus on as the management group?
How can we best help our colleagues to achieve growth in Science expertise?

It became my role to work with Bob to plan the workshop days for the group. I planned carefully so this could be done to best suit our needs. Traditionally at Exeter meetings and workshops are held on the school campus whether at lunch time, after school or in non-contact time with children. Half day and whole days sessions are held in the library. Unfortunately groups are often frustrated by being interrupted to take care of day to day requests, phone calls and leadership tasks.

My time is particularly endangered in this way. As a result I chose to take the group off campus and organised the session at the Launceston Teachers' Centre. I organised for lunch to be catered for, arranged relief and organised for Bob to attend our workshops.

Bob and I planned workshops collaboratively, taking into account the aims of the developing Science K-12 program as well as responding to the needs of Exeter and individuals in our group. Input by the whole group was encouraged. All workshop sessions were commenced and concluded with feedback sessions where people expressed concerns, asked questions and made recommendations. Consultation and collaboration were features of the process.

From April until October the workshop sessions were conducted with the Key Teachers in Science Group and the results were amazing. Three hands-on workshops were organised at the outside venue led by Bob

Phillips. These involved pre-reading, exploring Science teaching and content, planning of Science units, organisation of materials and practise of a variety of teaching strategies. The final three sessions were conducted back at school during evenings from 4pm to 8pm where we worked on the publication of materials, and revised and edited until we had reached final draft form ready for the new year.

The year 1994 was earmarked as our year of widening the professional development to include all staff. We opted to place Science teaching back in classrooms and maintain my services as a 0.2 time Specialist Science Resource Teacher assisting teachers in trialling the Science Curriculum Broadsheet and prepared units. The Science Room was maintained and available for booking purposes, resourced as in the previous year. This popular innovation, which I coordinated, was used eagerly by classes.

Planning was underway for me to work alongside teachers in classrooms and workshops were organised. Enter the architects, tradespeople and

phase 2 of the redevelopment began! Seventy-five percent of the school was to be rebuilt, refurbished and classes were being conducted in venues such as the Physical Education store and on the hall stage. The Science Room disappeared and the resources were stored beneath the stage in boxes.

Teachers worked on in extreme circumstances, but plans to develop Science were scaled down to maintenance level. Teachers were trialling a variety of strategies, work was appearing at assemblies and in displays around the school. Science teaching strategies were becoming obvious in all areas of the curriclulum.
In term 3, when some sanity had returned, the Key Teachers in Science Group presented a number of workshops immersing teachers in hands-on Science experiences, demonstrating appropriate new teaching strategies and helping to disseminate the school Science Curriculum Broadsheet and units of work.

Teachers identified units which they would trial, strategies they would incorporate into the program and Science was buzzing again. The Science Room was not yet available but lots more people were fossicking around under the stage.

REFLECTIONS
People became involved in and committed to the Science project at Exeter because the community of learners was turned-on to Science. In my experience nothing excites teachers and parents more than children's enthusiasm, children's engagement in worthwhile learning and children's willingness to keep trying. Once I had established that there was something to 'this Science teaching' the whole community was hooked and committed their support to the program in a variety of ways already outlined.

In all humility I would suggest that my enthusiasm, sincerity and hard work started the ball rolling. From that point, consultative, collaborative planning, initiative and a willingness by the Key Teachers in Science Group to achieve positive outcomes for the whole school, kept the momentum going.

My assertiveness on behalf of the Science Group in senior staff forums was a bonus. I was able to grasp opportunities to put forward views which influenced decision making. There is no doubt in my mind that the right attitudes and interest modelled by senior staff went a long way to ensure worthwhile professional development opportunities in the school.

The Key Teachers in Science Program impacted significantly on the ability of the Science Group to achieve its goals. With a vision so clearly focussed on raising the profile of Science teaching, the

production of appropriate curriculum materials, and the assistance offered by Bob Phillips, all contributed to our success.

Demystifying Science and Science teaching was an aim throughout the project and we actively encouraged this attitude through the Key Teachers in Science Group. At all opportunities, group members initiated Science discussion, helped other teachers with ideas and resources and offered support. This assistance was very much in the hidden curriculum of staffroom interaction, classroom discussion, as well as on more formal sharing occasions. This was a practical example of what amounted to an unofficial peer support program.

Parent interest and enthusiasm encouraged me, the group, the staff and the students. The parental interest and support was certainly reflected in children's learning and positive attitudes to Science.

The group was assisted by teachers becoming more comfortable and making their needs, problems and anxieties known. Group members maintained a role of supporting and encouraging colleagues. I have the utmost praise and respect for the contributions of the Key Teachers in Science Group. Despite the fact that we had worked together, through a process of exploring deeply our knowledge, beliefs and values, we made sure that our deliberations were worthwhile and of value to our whole school community.

When it was no longer necessary for me to provide all the leadership, enthusiasm and planning required I tried to step back from the process and see what was happening. This was really difficult as it had become quite a passion for me.

On reflection, what was needed most was the need for a sense of humour, the ability to laugh at oneself and with each other. I came to value the ability to listen, understand and share by getting difficulties into perspective. Celebrating successes, however small, encouraged individuals to try even harder.
I derive a great deal of pride, as well as personal and professional satisfaction, in the part I played in supporting the growth of Science teaching at Exeter. Mine was a pivotal role and I feel that I coped sensitively in helping my colleagues to learn and grow. Keeping the vision for Science teaching clearly in focus throughout, assisted me in leading the group and ensured that our goals were met.

SO WHAT HAS CHANGED IN SCIENCE TEACHING AND LEARNING AT EXETER?
The Science program at Exeter is now firmly established and has a strong hands-on approach. Teachers make a deliberate effort to involve girls and boys equally, all of whom participate with equal enthusiasm.

The Science Room is restored to use once more as a resource room and operates on a booking system where staff are able to use blocks of time to conduct units of work. Teachers vary the use of the room according

to their needs. Some activities are conducted within the normal classroom. All classrooms have been provided with Science kits containing a variety of daily Science needs. As well, unit boxes on themes have been developed to assist teachers. My teaching component continues to provide assistance in classrooms, but this has now become a team-teaching approach where teachers and I plan together, teach together and combine our Science teaching skills.

Students really like the Science Room. These are examples of responses from students and are typical of the school as a whole:
Grade 6: They enjoyed having a special room for Science; it helped concentration; had a quiet atmosphere and, "... it's more like a High School when you have a Science Room."
Grade 5: They enjoyed having a regular time for Science; "Being in another room can help you concentrate on one subject."
Grade 4/5: "You can make more mess in the Science Room when you work on things."
Grade 4: "Going to the Science Room makes you feel special." There is more equipment available as well as better resources.
Grade 2: They liked to be able to find things; "I need lots of things to do my ideas."
Grade Prep/1: "Science is a lot of fun and we get things to help us in the Science Room."

Changes have been very obvious in our third year of Science implementation in 1995. The curriculum materials which we were using in draft form were finally published by the Department of Education and the Arts and issued statewide. Teachers took considerable pride in receiving the packages and expressed their pride in our school's involvement in the production of this resource.

Changes of direction in school planning and goal setting have impacted very favourably on Science teaching. The Parent/Teacher Planning Group revisited the School Plan late in 1994 to reflect on progress in achieving our goals and to identify directions for the future. Their deliberations resulted in Quality Teaching and Learning, being nominated as a school priority, to continue the work undertaken so far in our stated priority areas.

Primary teachers work hard to connect and make links across the curriculum, striving to build a sound foundation of children's learning experiences. The threads which make up the tapestry are intricate and interdependent. As a school we had moved from 1992's identification of need to 1993's exploration of 'Best Practices' across the curriculum, by the whole school community. Science practices, in particular, were the focus of the Science Group where we worked through those teaching strategies which would bring about the appropriate learning outcomes for children.
A large number of teaching strategies (eg Brainstorming, Mind Mapping,

Concept Attainment, Design Briefs and a list of Cooperative Learning strategies) identified by our group have been explored and practised in classrooms with the goal that they eventually become embedded in the individual teacher's repertoire. Within a supportive collegial and collaborative environment, teachers have given each other permission to take risks, try new ideas and reflect on their successes. Teachers throughout the school have grouped in pairs to plan and work together, practise new skills and observe each other working. We are exploring the notion for 1996 of setting up support teams (three pairs) of interested teachers to continue this work.

The notion of key teachers has become a part of the operation at Exeter Primary School. The activities of our group were perceived to be so successful this model is now commonly used in the school. The Mathematics Group are completing their first year of reviewing the curriculum and are currently fine-tuning the Curriculum Broadsheet. A Technology Group has been formed by several teachers in the Science Group with additional interested teachers and have presented the first independent budget for Technology for 1996.

The Key Teachers in Science continue to have an important role to play

in leading Science teaching in the school, especially in helping teachers to understand the package of materials which support our curriculum and to assist teachers to devise additional units to suit the needs of their classes. Professional development activities are also coordinated by this group and emphasis has been placed on skilling teachers in the Energy strand and Natural and Processed Materials strand.

The years 1993 to 1995 have been a challenge to us at Exeter Primary School, not only in Science teaching, but in coming to terms with teaching and learning. Exeter is moving forward at a very rapid rate. There is a thorough, well-planned professional development plan in place and an understanding of the hidden curriculum of day to day professional learning experiences. Teachers have the opportunity to reflect, refine, update and refresh within the structure of the ongoing educational program of the school.

As a group of teachers we work together, help and support each other both in teaching and learning. We reflect on what effective teaching and learning is all about, particularly in Science teaching. In addition, we cope with the day to day lived experience of being a teacher and a learner.

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Mathematical Reculturing at Smithton High School

Greg James

Smithton High School has about 550 students from grades 7 to 12. It is located in the town of Smithton which has a population of approximately 3500. The school draws students from the town of Smithton and from the surrounding rural district. At least three quarters of the students bus to and from school, some of them travelling an hour each way. Smithton High School is the only government high school within the municipality of Circular Head. The district is semi-isolated from urban life, the nearest city, Burnie, being 90 kilometres from Smithton. This semi-isolation produces a relatively strong sense of community identity. One result of this is that many of the high and primary school teachers who work in the district know each other. It is relatively easy to extend these social relationships into professional relationships which bridge the gap between the primary and secondary education systems.

A variety of circumstances combined to provide the necessary impetus for the innovation in Mathematics at Smithton High School. They were:
dissatisfaction, by the eventual key teacher, with the inability of students to apply their mathematical learning and to form lasting understandings of important mathematical concepts;
the arrival of a head of department, who shared the concerns of the key teacher, at the school;
professional development contact between the key teacher and visionary mathematics educators, some of whom were later involved in the writing of the National Statements and Curriculum Profiles (AEC, 1991; AEC, 1994);
having to cope with heterogeneous groups;
publication of innovative resources such as the Mathematics Curriculum and Teaching Program (MCTP) (Lovitt & Clarke, 1988) and the Resources

In Mathematics Education Project (RIME) (Lowe & Lovitt, 1986), and other books (Stacey & Groves, 1985; Palmer, 1986; Hill, 1987) about problem solving in mathematics;
having to cope with out of area (ie specialising in a different subject area) teachers;
publication of the National Statement for Mathematics (AEC, 1991) which supported the views of the key teacher and the head of department;
literature from the Tasmanian Department of Education and the Arts (DEA, 1992; DEA, 1993) supporting a constructivist model of learning; and
identification of Mathematics as a priority area by the DEA.

The change process was initiated as a result of points (1) to (6). However, points (7), (8) and (9) were important in providing legitimacy and momentum to the change.

In any change process one needs to decide where to start. The key teacher and head of department decided that students' inability to apply their mathematical learning was the biggest problem, thus students needed problem solving skills which would work, for the rest of their lives, in a range of situations. Ten such problem solving strategies were identified, namely:
guess and check;
look for a pattern'
act it out;
draw a diagram;
write a number sentence;
make a chart or table;
solve a simpler related problem;
work backwards;
eliminate unsuitable answers; and
account for all possibilities.

A review of literature (see for example, Stacey & Groves, 1985; Palmer, 1986; Hill, 1987) helped in this identification. The key teacher was then timetabled onto the target grade (grade 7) and he started to base his teaching on these generally applicable skills in all topic areas. It was made clear to students that they should consciously use the problem solving strategies all the time. Students also were shown when they unconsciously had used these skills in the successful solution of problems. A curriculum focus on these strategies was provided by doing a problem solving unit early in the year. At this stage it was decided that ten strategies would be too many for students to practise all at once and so guess and check, look for a pattern and draw a diagram were chosen to be the focus. Once the problem solving unit was completed, the strategies were not forgotten, they were used in all other topics throughout the year. Posters were put on the walls in classrooms to continually refocus students and teachers towards the use of the

problem solving strategies. Such use occurred all the time in the key teacher's classroom.

At this stage of the innovation, most pedagogical change occurred in the classrooms of the key teacher and the head of department. These two engaged in a continual cycle of intention, experimentation and reflection, both individually and collaboratively. Informal one-to-one discussions between the key teacher and other Mathematics teachers on the same grade provided extra view points and were important in guiding curriculum improvements. Vital support was given to some out of area teachers by indicating to them which learning activities would work well. It was the key teacher's job to provide documentation of the program for these teachers. This largely was centred on content, but some points of teaching methodology were included. Discussions between the out of area teachers and more experienced colleagues took place regularly.

The same process continued in the following year as the innovation was extended into grade 8. Two more problem solving strategies were highlighted: solve a simpler related problem and work backwards. In addition, more effort was made to provide a wider variety of learning activities so that more students could have a chance to make meaning of mathematical concepts. The commencement of heterogeneous classes in grade 8 provided an impetus for more action to be taken in this regard. Algebraic concepts were seen as a particular concern and thus the algebra unit, when documented, provided a wide variety of activities which addressed the concept of an algebraic variable. It also provided more documented details on teaching methodology than any previous unit. The MCTP and RIME lesson plans were used as models in this documentation.

The following year the key teacher went on exchange to the UK. This had a two-fold effect. First, the materials prepared so far for grades 7 and 8 were used by a group of teachers without the key teacher being present. Some of these teachers, including the British exchange teacher, had not been involved with the innovation so far. An evaluation of the materials was provided for the key teacher to examine upon his return. Second, the key teacher was forced into using the British Secondary Mathematics Project (SMP), due to an intracluster agreement, during his year in Britain. The structure of this system was so different to that used at Smithton High School that it provided an ideal opportunity to examine the characteristics of students brought up in a different mathematical culture. The reflective opportunities provided by this stark contrast were invaluable in helping to decide the necessary elements for a quality mathematical curriculum.

The key teacher and the head of department used all the information gathered so far to identify the key elements of a quality mathematics program when the former returned to Smithton High School from exchange overseas. They reaffirmed the importance of students having general

problem solving strategies to use in a variety of situations. Guess and check, look for a pattern, act it out, draw a diagram, solve a simpler related problem and work backwards formed the basis of these strategies. The importance of students constructing their own meanings of concepts was given increased focus. Mathematical tasks were set in a variety of meaningful contexts to help students make connections with other areas of learning. The balance between closed and open ended activities became more appropriate. More thought went into opportunities for both individual and collaborative work. The five capabilities from K-12 Frameworks (DEA, 1993) (ie personal, linguistic, rational, creative and kinaesthetic) were considered more in curriculum design in order to cater for a wider variety of learning styles. An

appropriate mix of exposition by the teacher, discussion, practical work, consolidation and practice, problem solving and applications, and investigational work was embedded into classroom management through curriculum design. Assessment practices became more formative and developed more responsibility in the students for their own learning. Above all, students were challenged and yet still provided with opportunities for success.

Teachers were supported through improved design and documentation of the program. The learning activities were tailored to meet the parameter mentioned above. More documented hints on methodology were provided than ever before. Informal discussions with key personnel helped less experienced teachers. Dialogue between all teachers provided reflective opportunities and helped to continually improve the activities. More organised meetings were held for the relevant teaching team. At these, teachers experienced new learning activities, examined their intended outcomes, and considered how best to implement them. Activities were also redesigned and sometimes ideas were conceived for new activities within the outlined parameters for a quality program. Later meetings examined the work of selected students to decide upon the real outcomes of the learning activities. Teaching materials were more organised and were available for teachers to use at a moment's notice. This reduced the amount of time that teachers had to spend on low level organisational tasks. Extension activities were provided which were not more of the same, and the documentation of the program was bound so that individual parts could be changed without having to republish the whole document. This was done to facilitate continual improvement rather than long periods of stagnation, which would then be followed by radical change.

Throughout this process the key teacher was responsible for identifying quality learning activities from existing literature and arranging documentation of quality activities from other sources. These were made available to teachers throughout all stages of the development of the program, but teachers were free to implement the aims of the program in their own way. Thus, the need of a paradigm shift was

balanced against the need to support the individuality, creativity and self-worth of the teachers involved. Indeed, it was recognised that teachers needed to construct their own meaning of the aims espoused in the National Statement on Mathematics (AEC, 1991) (constructivism works for adults too!) and one aim of the Smithton High School Junior Mathematics program was to help teachers to do this.

Parents were involved in the innovation mostly through parent evenings at the school. Early sessions identified concerns of parents. Later sessions involved parents working through the classroom activities so they could see the practical means being used to improve the education of their children. The purposes behind activities were always addressed during these sessions. Experimentation with different venues, communication methods, nights, and times of the year was a part of trying to increase parental attendance at these sessions. Some parents also visited classes to see the Mathematics curriculum in action. Debriefing sessions after these visits helped to improve parents' understanding of the program. Some parents helped to bind the documentation of the program and to organise the parent evenings. This latter group's understanding and ownership of the program was the greatest out of all the parental participants.

In conclusion, it is clear that the aim of this innovation was to help all students: develop widely applicable problem solving skills; construct real understanding of mathematical concepts; and have the confidence to use their mathematical knowledge and skills either

independently or collaboratively in later life. Teachers must be facilitators of learning, rather than experts imparting knowledge if this is to be achieved, and the documentation and practical professional development support provided to teachers was vital in helping them to change their traditional roles.
Parental understanding and support for the innovation was important and was best achieved by helping them work through the learning activities, and by having them observe students at work. References to intended outcomes were important during these sessions in order to help parents understand the link between theory and practice.

Finally, the key teachers, supportive senior staff within the school, and DEA policy were vital elements in engaging the teaching staff in the renewal process. The innovation would have foundered if any of these three elements had been missing.

At this stage the success of the innovation can best be judged by such things as: decreasing dependence of students upon the teacher when solving problems; a variety of thinking and recording strategies in evidence on any given task; students debating the validity of solutions with each other and with the teacher; students articulating their own personal understandings of concepts; students taking more

responsibility for their own formative assessment and subsequent learning; and increased parental understanding and acceptance.

It would be true to say that the innovation has been internalised to varying degrees by different teachers and as yet is not a school tradition. More collaboration is needed to achieve this for existing staff, and a special program is needed to support staff who are new to the school. Nevertheless, many of the elements necessary for successful innovation have been identified and implemented. Perhaps one day, in schools throughout Australia, we will have an acceptance by teachers, students, parents and the wider community that we are all life-long learners. Thus, we need to open our classrooms, schools and other insitutions to intelligent, caring and collaborative scrutiny, not for the purposes of putting people down, but for the purposes of improvement. If this becomes a tradition we will truly have had successful reculturing.

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What's a Chook?
Technology: Empowering teachers and students at Lauderdale Primary School

Bill Edmunds

THE CONTEXT

Lauderdale Primary School is a government K-6 primary school in a sought after seaside and semi-rural commuter town near Hobart, the capital city of Tasmania. The school was opened on another site in 1965 and moved to its current site in 1966. There have only been three Principals of the school; in position for six years, ten years and, currently, fifteen years, respectively.

The school buildings are overdue for a major redevelopment. Six classes and the music specialists are housed in demountable units. Only half the school can fit into the Gym/Activity space at one time; the specialist Art teacher operates in an underfloor cement bunker with a very low ceiling; and computer stations, learning stations and activities spill into the corridors.

Student enrolment has grown steadily and currently is just under 700 students. Class sizes range from 25 to 31. Students live up to 10 kilometres from the school. The feeder areas have undergone a rapid expansion and change from sparsely populated rural land and small seaside holiday villages, to a permanent predominantly commuter population. Well-built houses on one or five acre lots typify the new developments.

There are 35 teaching staff, including the Principal and two Assistant Principals, three administrative and office staff; and seven teacher aides, two of whom are permanently assigned to the two-classroom kindergarten unit. All but one of the teachers have always taught in primary schools. Six of the teachers are male.
Teachers are moved up and down the school frequently, but usually stay with one year level for up to three years. This, many say, keep them fresh while allowing them to build on knowledge gained over each year. The school has no power to select staff, but teachers could probably choose not to come if they don't like the style.

Lauderdale Primary School has a terrific staff team, with a terrific sense of relationship, and a fair degree of purpose. Teachers have a high workload, and have taken on the National Statements and Curriculum Profiles, technology and computer usage at a faster rate than other schools.

Lauderdale is a young community with little infrastructure, and the school is a focus for community activity. The qualities of enthusiasm, energy and vision needed to buy virgin land and build new houses while producing young families combine well with the school ethos of

supportive and appreciative encouragement of parental participation. The result is a parent body which makes an outstanding contribution in the provision of both financial resources and input of time. The school keeps parents informed with a weekly newsletter.

The parents are exceptional fundraisers; in 1994 when the school lacked good playground facilities, they raised about $20,000. In 1993 the need was for computers and CD ROMs. Many of the parents work in the technology/IT areas and saw the value in upgrading the school computer system. The parents raised $35,000 for that project.

The mission statement for Lauderdale Primary School is, "To provide a range of opportunities and experiences in a stimulating environment which nurtures a love of learning in students and develops active, independent learners and problem solvers".

The Innovation

Focus

The innovation at Lauderdale Primary School focusses on introducing children to computers at the kindergarten level and by grade 6 having them achieve a high level of computer literacy. Thus, the innovation is aimed at only one component of the technology area; computing.

Impetus and Context

Vision and supportive and confident leadership guides the school. I see that my roles include: to challenge, ask questions, and raise issues, to bring in expertise to support work in new areas, and to create an environment in which staff and students can take risks without feeling they are going to be criticised.

The world of tomorrow is one we cannot predict, and an awareness of the need to exchange information and ideas locally and globally, necessitates that students be given a flexible, confident and problem solving approach to the technology of the future. My vision includes Internet access in every classroom; "If kids can communicate earlier then there is a chance of peace and international friendship."

In 1991 the Motec initiative (a mobile technology unit, now discontinued) came to Lauderdale Primary School. The Primary Assistant Principal had recently completed his MEd thesis on technology and introduced the Technology Challenge which has since become an annual all-school venture at Lauderdale Primary School. He also participated in preliminary meetings about technology guidelines for both Our Children: The Future and the National Statement and Curriculum Profile

for Technology, and he and I are well informed as to the future direction of technology education.

Individual teachers increasingly were asking for facilities for email for students to contact schools abroad, and stating a need for better self publishing facilities for the students than the single BBC computer shared between two classes, and the solitary school printer. Since 1991, Lauderdale Primary School has organised its technology curriculum on the principles of design, make, and appraise. Computer technology is an integral part of the learning process. Its use extends across all learning areas; it is not a subject in itself except in the initial learning stage.

Goals and Content

I envisaged Lauderdale Primary School as a place in which teachers acknowledge the increasing importance of technology as a learning aid, a means of global communication and a tool to access information and in which teachers explore with enthusiasm theories of learning and refine

their approaches to teaching during the implementation of new curriculum field guides and frameworks for planning.

The goals of the innovation are:

to empower students to be confident and competent using computer hardware and software, including word processing, email, CD ROMs, desk top publishing, and multimedia;

to challenge students to be particualrly creative in areas of designing, making and appraising;

to focus on the students' skills to scan, access and appraise information;

to enable staff to recognise and to use the enormous teaching resource which Internet provides;

to skill staff to a level at which they could confidently use and teach technology in the classroom; and

to skill staff to be competent to run the computers and the network.

The school has set, and met, a priority that sufficient computers be available for students to learn as a class, and to be able to practise their skills at other times. The minimum we set was two computers and a printer in each classroom, plus a networked laboratory of 32 computers. The laboratory has open access before and after school and at recess and lunchtime.

Students start to use the computer laboratory weekly whilst attending kindergarten. Simple games help them gain dexterity with the controls which move the pointer around the screen and which complete one task and move on to the next challenge. They also use number recognition and alphabet recognition programs.

In the following grades they use games which are designed to increase various competencies, such as Literacy and Numeracy, and to challenge and extend their knowledge in the various learning areas. In grade 4 they are taught key boarding.

Email can be introduced as early as grade 1, with the teacher arranging for the class to communicate with a similar class abroad. By grade 5, some children are accessing the Internet and communicating in real time with their peers overseas.

The classroom computers use more sophisticated software, and children are using graphics and desktop publishing programs on these from about grade 1 onwards. The choice of software is up to the individual teacher. Some are confident with sophisticated programs and can therefore introduce them to the students. Many grade 3 students are very confident with desktop publishing. One grade 6 class produces excellent multi-media work.

Students are introduced to searching databases by the use of the CD ROMs in the library, and can be seen as early as preparatory class playing with the terminals controlling the encyclopedias, and in grade 1 confidently using the Bookmark system to select and find books.

The next goal is to network the classroom and library computers; "So many students are now corresponding internationally and access is the problem. Therefore, the network is vital." A goal for the near future is to have a computer on each teacher's desk.

CURRICULUM CHANGE
The Development of Information Technology at Lauderdale Primary
The following is an outline summary of the moves towards an adequate level of InformationTechnology resourcing at Lauderdale Primary School.

By 1991, Lauderdale Primary School had acquired the provision of one computer per two classes; a total school provision of ten BBC computers, plus two printers.

1992 saw the purchase of eight more printers, plus some second-hand BBCs and two Acorn A3000 computers. The chief use of the computers was in the area of publishing children's writing, the use of thematic software, and for drill and practice activities. Our goal was to provide each classroom with a computer and a printer. This was achieved by the end of 1992.

1993 saw our first involvement for five years in telecommunications. This had a dramatic effect on the potential of this medium in a classroom environment. The projects a grade five class was involved in helped to consolidate thinking regarding the level of skill we were

providing our students. A keyboarding program for all children seemed to be essential. Thirty-two, second-hand, BBC networked computers were purchased to resource this program. This enabled three main activities to take place:
a keyboarding program from year 4-6 to be introduced;
a greater emailing capability by class groups; and
a roster of 45 minutes for each class in the Computer Centre each week.

1994 saw the consolidation of the global telecommunications program, with over ten classes being involved at one time. The move to extend our access to the Internet into each class became an objective. A dedicated TasNet access was established, but this was only a text based access.

1995 has seen our resolve for a school network firm. Eight classroom computers have been networked, thus sharing the software resources of the school.

Email classroom goals
(1)Improving communication.
Writing skills (clarity, spelling, etc).
Learning to interact confidentially and sensitively with people from other cultures.
Practising a second language with a native speaker.

(2)Understanding 'different' cultures.
What do other people tend to do and think about?
What have they created; what are they proud of; what are their concerns?
Discovering new, personally, important meanings in the world.

(3)A global village and its people.
Putting names, (faces?), feelings, personal characteristics to people in distant locations.
Understanding culturally different people as people, not foreigners.
Finding common ground with culturally different friends.
Growing to trust and appreciating other individuals who may be from very different cultures than our own.

(4) Understanding one's own culture.
Reflecting on ordinary life in relation to that of one's email partners.
Understanding one's self as a product of forces that could have been very different in a different culture.
Incorporating a cross-cultural perspective on personally meaningful values, issues or ideas.

(5)Thinking critically about ...

Using differences between the personal report of one's email partner's behaviour, thoughts, and values from that reported in books, teachers, newspapers, etc to reflect together on "why the differences?"
Gaining skills for approaching people in any cross-cultural encounter with respect and an appropriate openness to learn of their unique personal and social perspectives.
Collaborating with email partners to examine an issue (eg pollution, peace, population growth) that is of common interest.

(6)Learning the skills of the future.
Electronic mail is increasingly important as a fast means of transferring information; it is important to learn those skills.

PEDAGOGICAL CHANGE: A TEACHER'S PERSPECTIVE.
Present Technology Work Within the School
The following comments were made by Helen Sweeney, the teacher of one of the year 6 classes at Lauderdale Primary School and focus on how she uses technology in her teaching.

Information Technology
This has had a huge impact on our thinking globally and on the children's ability to creatively interact and use computers effectively. They are much more familiar with them generally and automatically think of them as another option when considering how best to approach a topic. They are motivated, enthusiatic and empowered. And so am I!!

The Network
Eight classes are presently linked to the main file server located in the Assistant Principal's office. This allows for sharing of work between classes; for example, multi-media Magpie newspaper about Maria Island history produced by year 6 for shared reading partners to read in year 1/2; and prime solver problem solving challenges created by children for others to access and try in their own classroom.
Users have access, through the server, to a wider range of software so they don't need to rely on disks for copy.
An inter class mail service has been established.

Electronic Mail
Students are online to keypals in other countries, getting immediate replies in minutes.
Overseas mailing between classes occurs; for example, 6 Sweeney has 2 classes it writes to from Finland and Canada. There occurs exchange of cultural information and discussion topics of relevance to the children and current affairs. For example, we researched information for persuasive writing about the French Nuclear Testing in the Pacific, wrote our opinions out and then sent them to our penpals. They are writing to give us their perspective from so much further away.
Students are involved in Enviroquest and other national competitions involving problem solving, using email to receive the daily clues from

Canberra and send our class suggestions.

The World Wide Web.
We have own home page where we display information about the school and children's work to a world wide audience. This is also networked within the school. Through providing email links within the Home Page, the children get responses from overseas children who have read their work. The children will be working to redesign their class Home Page as part of our technology activities this term.
We link up through our text based web link to the Home Page of our

Canadian penpals and view their published work too. We can also, at a later date, see their photographs and art work, etc instantly this way rather than having to wait for surface snail mail.
We have been chosen to trial the use of WWW as a classroom resource.

The Library
There are eight IBM compatibles, networked, running an automated library system, and CD ROM. We use this for researching topics of interest such as the information we needed for Enviroquest. We also conducted searches on the Web to the Antarctic Division's Home Page for this activity as the competition was set in Antarctica.

The Computer Laboratory
There are 30 BBCs used for whole-class publishing of work and keyboarding practise. There is also access to a number of software programs for whole-class use. I use this for keyboarding practise and for whole class publishing of work in one afternoon.
There are two Acorn 3000 computers, one used as another computer to run extra copies of programs so that 6-8 children can work in pairs on the one program at a time (for example, Prime Solver) during technology circuit of activity times.

The Classroom Computers
Each class has one Acorn 3000 computer (2Mb+Riscos 3) plus one printer per room. I use this to create with the children authoring, multimedia books about relevant topics (for example, Maria Island), a maths based challenge story (created by 2 grade 6 girls last year), and children's personal author information. I run these in the corridor for the parents to view during Parent Teacher Interviews etc.
Classroom teachers have access to two Acorn 3000 laptops and four pocketbooks. I use these for publishing and design; for example, using Draw to design their own logos.
Teachers use computers to aid children designing and to enhance their understanding of systems.

Desiging, Making, Appraising
The following are examples of activities conducted within the class that emphasise the design, make and appraise approach:

literature based challenges;
theme-related activities that emphasise a technology aspect; for example, from a theme about water, designing and making a form of underwater transport;
cross-age tutoring involving the creation of such items as waterwheels;
whole-school challenges; for example, bridge making, land yacht, tin can roller;
classroom designs and models;
moon buggies; and
after discussion at staff meeting where grade 3 teachers complained of children having difficulties learning to order from the canteen, a grade 6 class designed and made teaching kits which could be used in those classes. The success of these was judged when the children who had created the kits went and used the kits with the grade 3 students.

Planning
When planning a unit of work, planning is done to include all curriculum areas in an integrated approach to ensure relevance. The curriculum profiles document is consulted in planning activities to provide a balanced approach and curriculum. It is also consulted at later stages in the unit of work to allow for unexpected branches of investigation.

In conclusion, teachers tend to use checklists when observing children

at work to later use for assessment. Teachers are still struggling to come up with a truly feasible approach to assessment, collaborative planning and peer support programs.

"And what is a Chook? We want to know all about Tasmania."
The use of electronic mail to communicate with teachers and students in other lands is a powerful aspect of Lauderdale Primary School's learning program. It is an excellent means of learning more about the culture of another society, to compare and contrast the way we live and work. Most of all, it provides a human face to learning and enables students to exchange ideas and feelings with peers in other places. Students are writing within a meaningful context; there is purpose and they have an interested audience. Read this exchange between Lauderdale Primary School Year 5 teacher, David Gatenby, and Linda, a teacher in the Ryal School, on a Creek Indian Reservation in Henryetta, Oklahoma.

Hi Linda,
Just a note with this ending of 5G POST/2. This idea is just starting to roll in the room and we would really like it to Ôgrow on you' too. Following the 'little and often' policy, please accept these offerings of our thoughts ...

Contents today are two poems by Ella Walker and Katie Miller. Both girls were challenged to produce original work on ideas that interested them. They hope that you will enjoy their work.

HOMELESS
I'm all alone,
Roaming the streets.
I feel like an ant in a huge jungle,
The buildings are so tall.
This city is so big, so colourful and bright,
But then there's my alley so dark and cold.
And then there's my home,
A small cardboard box,
With a half-ripped scarf as a blanket.
I have three friends who are chefs who give me their left overs.
Maybe one day, someone will find me and take me home.
One day.
a poem by Ella Walker

WILD HORSES
It was dark.
I saw a spark.
Thundering hooves,
In the ground,
Making grooves.
I saw ?
Like thundering waves,
Coming towards me.
I see ?
Colours all different.
I don't think they meant,
But they changed.
I wonder ?
Coming off the plain,
Little groups,
Joined a main,
Colours of a tail,
Let off a wail.

I saw ?
I see ?
I wonder ?
a poem by Katie Miller

"Hisjay" - Hello in Creek!
We loved the 'thoughts' sent by your students. They sound great! We read them and we could all get a mental picture of the homeless person ... excellent! There are several of the students and they related very well to the "horses" also. Keep them coming!!!

We did finally find you guys. We had found the island of Tasmania, but we did not know for sure where you were located on the island. We are 90 miles east of Oklahoma City and 50 miles south of Tulsa. Lake Eufaula is about 15 miles east of us right of 1-40 highway. It is one of the largest man-made lakes in the U.S. It was made along the river and you can walk along the sandy beaches and find lots of arrowheads from where the Indians lived along the river.

We are sending a thought from one of our students ... these were MUCH harder for them than the describing. I loved the idea and so did they, so they plan on trying to get their 'creative juices' flowing.

Have a great week-end David. I saw one of the books you are reading I think ... it was People and the Lake ...I am going to try to find the first ... People of the Wolf?

THE FARM
The hay is in the barn
The feed is in the barn
The grass and dirt are on the ground
The swing on the tree is swinging.

The clouds are in the sky
The birds are flying up above
The chickens are laying eggs
The horses and cows are grazing in the pasture
The dogs are playing
and so are we.

Take care.
Linda

PROFESSIONAL DEVELOPMENT
Start small, think big and seize the moment! As teachers show interest, support them and nurture their interest. Encourage them to take risks. Seek out opportunities through which they can increase their own knowledge, understanding and skill levels. Above all, ensure that teachers have ready access to the technology so that they can utilise and maintain their new found skills. Engage in a process of continuous improvement.

It is going to be important for our school to expand the provision of hardware and associated network facilities within the school. The first step will be to provide computers in corridors networked to the library to enable ready access to information by teachers and students.

A goal within the next twelve months is to provide each classroom with four computer outlets which will allow access to the library, local networks, email between classrooms and communication and access to

information globally.

The installation of the present network across six classrooms has led to a reduction in the time required to upgrade and maintain software.

Computer technology is a cross curricular tool for learning. Be creative. Dare to be different. Use information technology as a springboard for action, as a resource for ideas.
The nature of education is changing. Now is the time for schools to change their organisational structures and teaching methodologies to enhance and facilitate that change, to create time for collaborative endeavours. The students currently in Lauderdale Primary School will be graduating in the 21st century. We, as educators, have an obligation to these students, to provide them with learning opportunities appropriate to the needs of the next century, the Information Age.

TEACHER AND STUDENT RELATIONSHIPS
Developments in relationships have included an emphasis on empowerment; facilitation and guidance rather than direction; learning together; knowing what learning outcomes are expected and discussing these with students; making provision for all students to be included in the learning process; valuing all contributions; intervening as and when appropriate; sharing ideas; exploring possibilities; celebrating and appreciating achievements.

A high level of cooperation and collaboration is emerging between teachers and among students. A key element is the level of trust and responsibility accepted by students who have, for example, open access to the computer room before school, during breaks and after school.

I would like to acknowledge the collaborative efforts of the following people towards this paper: Bernard Hoggett, Assistant Principal; Helen Sweeney, AST1, Year 6 teacher; and David Gatenby, AST1, Year 5 teacher. Additionally, the support and contribution of the many other teachers at Lauderdale Primary School who are actively engaged in the use of information technology is acknowledged and greatly appreciated.

On support for innovation: Who or what is the driver?
Robert Phillips

Recently I was asked to establish a systems perspective for a group participating in a Principals of the Future program (a recent Tasmanian Department of Education innovation). To do so, I quickly loaded a metaphorical wheel-barrow with some of the curriculum and policy documents released over the past five years. The documents overflowed

onto the floor and established a graphic picture of the systemic requirements, assistance and demands upon schools.

The purpose of the exercise was not to mock the validity or usefulness of the documents. Each was a response by the system to assist schools in facing issues of importance to schools. The documents ranged from outdoor education guidelines, policies on curriculum balance, national statements and curriculum profiles, equity policies and national action plans for the education of girls, to the recent Education Act and its raft of interim guidelines and the Commonwealth Disability Discrimination Act and its requirements of schools.

The point of the exercise was to highlight the veritable library of materials that schools are required to take in to account in their day to day work and to ask the question, 'Who or what is driving the agenda

in your school? Is the direction in your school determined by each bit of the picture (the individual documents) or are the bits contributing to the school's pursuit of some more coherent goal based on some fundamental principles?'

In my work, I often see examples of the former, where the bits are the drivers rather than the informers of school practices. This can be evident, even in teachers' planning, where in some instances, teachers have created exceedingly complex planning schemes in order to take into account all the bits required in the myriad of documents schools encounter. Examples of the latter, where the bits are subsumed into planners based on more fundamental principles (for example, a teaching and learning centred view) are in my view an approach which moves the teacher and the school away from a reactive situation to a position of being in charge. The bits are still important but are addressed within an holistic planning scheme which hangs together rather than an approach which correlates by topic.

In pursuing the notion of system support for innovation in the context of this OECD Science, Maths and Technology Education Project which examines innovations in Science, Maths and Technology in Tasmanian schools and colleges, I want to keep coming back to this notion of who or what is the driver of what is happening in schools. In this paper I shall be arguing that the school is the unit of change and I want to explore the conundrum of systemic support for innovation where the unit of change is recognised as being the school. I also wish to briefly explore how the natural tension between system and school can become a healthy and creative tension.

SYSTEMIC STRUCTURES WHICH SUPPORT AND GUIDE LOCAL INNOVATION

Within the Department of Education and the Arts, there is a Planning Branch which guides the development of overall policy, and a Programs Branch whose role is to support schools by producing curriculum support

materials and guidelines and to assist them in reviewing their practices with respect to Departmental policy. The Programs Branch consists of three sections, equity, development and implementation. Despite being considerably reduced in number since 1991, the branches are still active in policy development and development of curriculum support materials.

Seemingly similar to systems worldwide, Tasmanian schools are inundated by the pace of change and the priorities which they are required to address. In an attempt to limit the number of curriculum priorities which schools need to address at any one time, the Department introduced a priority planning cycle in 1993 which identified target priorities operating over three year cycles. Each target priority was to be supported by the appointment of a senior curriculum officer in each of the seven Tasmanian educational districts. Additional support was available to lower level priorities and in other non-priority curriculum areas.

During the period of this OECD project, Science, Maths and Technology were all supported Departmental priorities and priority area support was available through the Development and Implementation sections of the Programs Branch.

The project was endorsed at Deputy Secretary level and permission was given for the research team to collaborate with Departmental representatives in inviting appropriate schools to participate in the study.

THE SCHOOL AS THE UNIT OF CHANGE

The Department of Education and the Arts promotes school local management. Schools are required to manage system priorities within their particular contexts and are required to develop detailed school plans. Schools are accountable for the follow through of their plans to the District Superintendent.

While the system may determine generic priorities, schools determine the specific need within these priority areas. In all but one case of those studied in this project (see elsewhere in this paper for more details), the specific innovation is the initiative of the school. Even in the exceptional case where the school expressed being a part of a central initiative (key school in Science project), the school had already identified Science as a key priority and took advantage of the central project to further this end.

THE SYSTEM-SCHOOL TENSION

Much of the recent change literature builds on the work of Lawrence Stenhouse in the 1970s and reemphasise the school as the unit of

change. While the system has an important role in establishing theoretical propositions, reference materials, policies, guidelines and priority frameworks, the school remains the unit where these propositions are tested in practice. As such the school, in becoming a successful innovator, has also to become a learning community where the school culture encourages continuing inquiry and testing of practices.

It is in this area that the system can and does provide some support to schools in their quests. This support comes through the practical assistance of senior curriculum officers and through the provision of frameworks, policy documents and the like. In this sense the system can provide a useful external stimulus to continuing evaluation of school practice by the school. In this sense the system-school tension can be a healthy, challenging, creative tension. To achieve this state, however, a recognition is required of each partner's contribution to the process of change and learning, of theory informing practice and of practice informing theory. In other words, both system and school acknowledge the role of the other in the improvement of practice.

It is my hope that this culture of a school learning community in partnership with a system can become more formally established. I believe we are beginning to approach this point. An example of this is to be found in the work of the Programs Implementation section where the research into change and learning organisations is strongly informing the work that officers are doing in schools. The section actively encourages officers to recognise schools as the unit of change, and to assist schools to establish themselves as learning organisations.

At the moment though, I feel too many of our systemic structures remain top down. A big brother attitude, where mutual learning is not a part of the systemic structure, tends to create a climate which encourages avoiding risks; whereas learning involves taking risks! In the absence of a culture of organisational learning as the norm, I also feel that schools often find themselves in the position of reacting to too many bits without taking a view which is based on a more fundamental purpose and from there, tying-in the bits as supportive pieces rather than the drivers.

In several of the cases that are described in the OECD study, I believe we can see strong evidence to support this shift in culture. Some of our schools are undoubtedly emerging as learning organisations

committed to continual inquiry and ongoing improvement.

The shift in language and practice which is now evident in many sectors (for example, law, business, politics; not just education) gives me hope that we will begin to see a shift towards the establishment of

system-school partnerships which recognise the important contribution each part of the system makes to the learning and progress of the system as a whole. It is my hope that the establishment of such systems will actively encourage the emergence of many more schools, on a much more systematic basis, becoming partners in improving practice with the system. It is my hope that what is now written-up as innovation will become an inevitable structural part of our system.

Appendix A
Interview Schedules

For Staff Involved in Curriculum Administration of Mathematics
These interviews will be conducted by the Research Assistants in the case study schools. The school staff who will be interviewed may include one or several of the following: Principal; AST3; AST2; AST1. Any of these staff, or a combination of them, may be responsible for reworking, writing or implementing the curriculum innovations. For example, an AST3 may be responsible for overall curriculum administration in the school, but an AST1 may be responsible for rewriting the Mathematics curriculum at the grade 7 level.

The Research Assistant allocated to a school will need to ascertain for themselves who and how many people they will need to interview to gain the relevant data.

All of the interview questions solely concern the curriculum innovation which is occurring within the school.

1.Can you describe the present Mathematics syllabus(es) in this school? In particular, can you highlight the strengths and weaknesses of the present Mathematics syllabus(es) in this school?

2.What improvements have been made to the Mathematics syllabus(es) in the last two years?

3.Who has instigated these improvements?

4.Why were these improvements made?

5.What do you see as the purpose of these syllabus improvements?

6.(a)What provisions, if any, have been made for making Mathematics more accessible to a broader range of students (eg based on ability, age, gender)?
(b)Has this been effective so far?

7.What variations, if any, have been made to the way Mathematics is assessed?

8.(a)Are other curriculum areas involved in the teaching of Mathematics?
(b)If so, how are they integrated/linked?

9.What plans do you have to improve the Mathematics syllabus(es) in the future?

For Teachers of Mathematics
The Research Assistants attached to each case study school will conduct these interviews. The aim of the interviews is to allow teachers to tell their story about the innovation. Teachers who are involved in the teaching of the curriculum innovations should be interviewed. It may be convenient if they are interviewed as a group, at least once a week. If a group session cannot be conducted then individual interviews will need to be arranged. Feedback on earlier investigations can be given at this time to check on its veracity. All of the following questions relate to the curriculum innovation being investigated.

1.Can you describe the present Mathematics syllabus(es) that you teach? In particular, can you highlight the strengths and weaknesses of the present Mathematics syllabus(es) that you teach?

2.What improvements have been made to the Mathematics syllabus(es) in the last two years?

3.Who has instigated these improvements?

4.What do you see as the purpose of these Mathematics syllabus improvements?

5.How do you feel about teaching the current Mathematics syllabus(es)?

6.Have you noticed any differences in the responses of the students to the Mathematics syllabus improvements and their implementation?

7.(a)What provisions, if any, have been made for making Mathematics more accessible to a broader range of students (eg based on ability, age, gender)?
(b)Has this been effective so far?

8.How, if at all, have your teaching strategies varied in accordance with the Mathematics syllabus improvements? Can you please describe a typical lesson?

9.What variations have you made to the assessment strategies you use? Can you give an example?

10.(a)Are other curriculum areas involved in the teaching of

Mathematics?
(b)If so, how are they integrated/linked?

11.What new resources have the Mathematics syllabus improvements resulted in you using?

12.What innovative support mechanisms have you used to deliver the Mathematics syllabus improvements?

13.How relevant do you feel the Mathematics syllabus(es) is to students':
(a)experience
(b)future?

For Mathematics Students
The Research Assistants attached to each case study school will conduct these informal interviews. Students who are in the classes where the curriculum innovations are being implemented should be interviewed. However, the interviews should not get in the way of ongoing school work. If possible, they should be interviewed in small groups of four

or five. They should be chosen randomly from the class. Not all students in the class should be interviewed. All of the following questions relate to the curriculum innovation being investigated.

1.Can you tell me briefly about the mathematics you are doing this year?

2.Have you noticed any variation/improvement in the way Mathematics is taught this year?

3.How relevant do you feel mathematics is to your own:
(a)experience
(b)future?

4.Do you feel the mathematics you are doing is suitable for all students at this level? Why, or why not?

5.How, if at all, is Mathematics related to other subjects that you study?

6.Have you noticed gaps in your knowledge of mathematics? If so, what were they?

7.Have you repeated any work in Mathematics this year which you already knew? If so, what was it?

For Staff Involved in Curriculum Administration of Science
These interviews will be conducted by the Research Assistants in the

case study schools. The school staff who will be interviewed may include one or several of the following: Principal; AST3; AST2; AST1. Any of these staff, or a combination of them, may be responsible for reworking, writing or implementing the curriculum innovations. For example, an AST3 may be responsible for overall curriculum administration in the school, but an AST1 may be responsible for rewriting the Science curriculum at the grade 7 level.

The Research Assistant allocated to a school will need to ascertain for themselves who and how many people they will need to interview to gain the relevant data. All of the interview questions solely concern the curriculum innovation which is occurring within the school.

1.Can you describe the present Science syllabus(es) in this school? In particular, can you highlight the strengths and weaknesses of the present Science syllabus(es) in this school?

2.What improvements have been made to the Science syllabus(es) in the last two years?

3.Who has instigated these improvements?

4.Why were these improvements made?

5.What do you see as the purpose of these syllabus improvements?

6.(a)What provisions, if any, have been made for making Science more accessible to a broader range of students (eg based on ability, age, gender)?
(b)Has this been effective so far?

7.What variations, if any, have been made to the way Science is assessed?

8.(a)Are other curriculum areas involved in the teaching of Science?
(b)If so, how are they integrated/linked?

9.What plans do you have to improve the Science syllabus(es) in the future?

For Teachers of Science
The Research Assistants attached to each case study school will conduct these interviews. The aim of the interviews is to allow teachers to tell their story about the innovation. Teachers who are involved in the teaching of the curriculum innovations should be interviewed. It may be convenient if they are interviewed as a group, at least once a week. If a group session cannot be conducted then individual interviews will need to be arranged. Feedback on earlier investigations can be given at this time to check on its veracity. All

of the following questions relate to the curriculum innovation being investigated.

1.Can you describe the present Science syllabus(es) that you teach? In particular, can you highlight the strengths and weaknesses of the present Science syllabus(es) that you teach?

2.What improvements have been made to the Science syllabus(es) in the last two years?

3.Who has instigated these improvements?

4.What do you see as the purpose of these Science syllabus improvements?

5.How do you feel about teaching the current Science syllabus(es)?

6.Have you noticed any differences in the responses of the students to the Science syllabus improvements and their implementation?

7.(a)What provisions, if any, have been made for making Science more accessible to a broader range of students (eg based on ability, age, gender)?
(b)Has this been effective so far?

8.How, if at all, have your teaching strategies varied in accordance with the Science syllabus improvements? Can you please describe a typical lesson?

9.What variations have you made to the assessment strategies you use? Can you give an example?

10.(a)Are other curriculum areas involved in the teaching of Science?
(b)If so, how are they integrated/linked?

11.What new resources have the Science syllabus improvements resulted in you using?

12.What innovative support mechanisms have you used to deliver the Science syllabus improvements?

13.How relevant do you feel the Science syllabus(es) is to students':
(a)experience
(b)future?

For Science Students
The Research Assistants attached to each case study school will conduct these informal interviews. Students who are in the classes where the

curriculum innovations are being implemented should be interviewed. However, the interviews should not get in the way of ongoing school work. If possible, they should be interviewed in small groups of four or five. They should be chosen randomly from the class. Not all students in the class should be interviewed. All of the following questions relate to the curriculum innovation being investigated.

1.Can you tell me briefly about the science you are doing this year?

2.Have you noticed any variation/improvement in the way Science is taught this year?

3.How relevant do you feel science is to your own:
(a)experience
(b)future?

4.Do you feel the science you are doing is suitable for all students at this level? Why, or why not?

5.How, if at all, is Science related to other subjects that you study?

6.Have you noticed gaps in your knowledge of science? If so, what were they?

7.Have you repeated any work in Science this year which you already knew? If so, what was it?

For Staff Involved in Curriculum Administration of Technology Education
These interviews will be conducted by the Research Assistants in the case study schools. The school staff who will be interviewed may include one or several of the following: Principal; AST3; AST2; AST1. Any of these staff, or a combination of them, may be responsible for reworking, writing or implementing the curriculum innovations. For example, an AST3 may be responsible for overall curriculum administration in the school, but an AST1 may be responsible for rewriting the Technology curriculum at the grade 7 level.

The Research Assistant allocated to a school will need to ascertain for themselves who and how many people they will need to interview to gain the relevant data. All of the interview questions solely concern the curriculum innovation which is occurring within the school.

1.What are the strengths of the present Technology syllabus(es) in this school?

2.What are the weaknesses of the present Technology syllabus(es) in this school?

3.What improvements have been made to the Technology syllabus(es) in

the last two years?

4.Who has instigated these improvements?

5.Why were these improvements made?

6.What do you see as the purpose of these syllabus improvements?

7.(a)What provisions, if any, have been made for making Technology more accessible to a broader range of students (eg based on ability, age, gender)?

(b)Has this been effective so far?

8.What variations, if any, have been made to the way Technology is assessed?

9.(a)Are other curriculum areas involved in the teaching of Technology?
(b)If so, how are they integrated/linked?

10.What plans do you have to improve the Technology syllabus(es) in the future?

For Teachers of Technology Education
The Research Assistants attached to each case study school will conduct these interviews. Teachers who are involved in the teaching of the curriculum innovations should be interviewed. It is felt that they should be interviewed as a group, at least once a week, and feedback on earlier investigations should be given at this time. All of the following questions relate to the curriculum innovation being investigated.

1.What are the strengths of the present Technology syllabus(es) that you teach?

2.What are the weaknesses of the present Technology syllabus(es) that you teach?

3.What improvements have been made to the Technology syllabus(es) in the last two years?

4.Who has instigated these improvements?

5.What do you see as the purpose of these Technology syllabus improvements?

6.How do you feel about teaching the current Technology syllabus(es)?

7.Have you noticed any differences in the responses of the students to

the Technology syllabus improvements and their implementation?

8.(a)What provisions, if any, have been made for making Technology more accessible to a broader range of students (eg based on ability, age, gender)?
(b)Has this been effective so far?

9.How, if at all, have your teaching strategies varied in accordance with the Technology syllabus changes?

10.What variations have you made to the assessment strategies you use?

11.(a)Are other curriculum areas involved in the teaching of Technology?
(b)If so, how are they integrated/linked?

12.What new resources have the Technology syllabus improvements resulted in you using?

13.What innovative support mechanisms have you used to deliver the Technology syllabus improvements?

14.How relevant do you feel the Technology syllabus(es) is to students':
(a)experience

(b)future?

For Technology Education Students
The Research Assistants attached to each case study school will conduct these interviews. Students who are in the classes where the curriculum innovations are being implemented should be interviewed. It is felt that they should be interviewed in small groups of four or five. They should be chosen randomly from the class. Not all students in the class should be interviewed. All of the following questions relate to the curriculum innovation being investigated.

1.Have you noticed any variation/improvement in the way Technology is taught this year?

2.How relevant do you feel technology is to your own:
(a)experience
(b)future?

3.Do you feel Technology is suitable for all students at this level? Why or why not?

4.How, if at all, is Technology related to other subjects that you study?

5.Have you noticed gaps in your knowledge of technology? If so, what were they?

6.Have you repeated any work in technology this year which you already knew? If so, what was it?

Appendix B
Documents for Analysis

The following documents are required to be collected for analysis in order to help understand curriculum innovations in SMTE in the case study schools. The first three documents are held within the Faculty of Education, and, as such, do not need to be collected from the schools. The remaining documents should be collected. However, it is realised that some of these documents may be non-existent (eg teacher lesson plans), and thus, unable to be collected. It is hoped that documents not mentioned on this list, but which may be important to the study, will also be collected. The Research Assistant allocated to each school will be best suited to ascertain whether any additional documents need to be collected.

1.DEA curriculum and assessment guidelines.

2.Schools Board syllabus documents.

3.National Statements and Curriculum Profiles.

4.School written/annotated syllabus documents.

5.Teacher programs (for the term/year).

6.Teacher unit plans.

7.Teacher lesson plans.

8.Assessment guidelines (teacher and school) and items.

9.Student journals.

10.Copies of student work and assessment items.

11.Teacher produced resources (eg worksheets) and external resources (eg text references).

12.School written cross-curricula or extra-curricula documents; for example, special needs, language, industry liaison.

13.Minutes of meetings relevant to the curriculum innovation.

Appendix C
Student Journals

Mathematics
Please fill in the following information:

NAME:

SCHOOL:

GRADE:

TEACHER:

SUBJECT:

LEVEL:

You are asked to fill in one of each of the following pages at the end of each Mathematics lesson. Please take the time to think about your answers. There are no right or wrong answers, we are interested in your opinions. You will not be marked on this work.

The journals will be collected, when finished, by the Research Assistant visiting your school.

Thank you for your help.

PERIOD: _____DATE: _____

1.What things did you learn or do today in Mathematics? (eg adding fractions worksheet; built solids using triangles, squares and hexagons)

2.What things were interesting in today's Mathematics lesson? Why?

3.What are the links between what you learned today in Mathematics and other subjects you have studied? (eg measurements in recipes for cooking; shapes in art; relationship between musical notes)

4.How could you use at home or out of school what you learned today in your Mathematics lesson? (eg baking a cake; checking your change from the shop; working out the top four sporting teams)

5.Please add anything else about today's Mathematics lesson you would like to tell us.

Science
Please fill in the following information:

NAME:

SCHOOL:

GRADE:

TEACHER:

SUBJECT:

LEVEL:

You are asked to fill in one of each of the following pages at the end of each Science lesson. Please take the time to think about your answers. There are no right or wrong answers, we are interested in your opinions. You will not be marked on this work.

The journals will be collected, when finished, by the Research Assistant visiting your school.

Thank you for your help.

PERIOD: _____DATE: _____

1.What things did you learn or do today in Science? (eg study and build a volcano; investigate the workings of an ant colony)

2.What things were interesting in today's Science lesson? Why?

3.What are the links between what you learned today in Science and other subjects you have studied? (eg designing a bridge in Technology; colours in art; energy in physical education)

4.How could you use at home or out of school what you learned today in your Science lesson? (eg understanding the weather report; growing plants in the garden; understanding why cakes rise when baked)

5.Please add anything else about today's Science lesson you would like to tell us.

Technology
Please fill in the following information:

NAME:

SCHOOL:

GRADE:

TEACHER:

SUBJECT:

LEVEL:

You are asked to fill in one of each of the following pages at the end of each Technology lesson. Please take the time to think about your answers. There are no right or wrong answers, we are interested in your opinions. You will not be marked on this work.

The journals will be collected, when finished, by the Research Assistant visiting your school.

Thank you for your help.

PERIOD: _____DATE: _____

1.What things did you learn or do today in Technology? (eg design a dress; draw a house floor plan using computer graphics; plan a meal)

2.What things were interesting in today's Technology lesson? Why?

3.What are the links between what you learned today and other subjects you have studied? (eg textile designs based on art; scale drawings and measurement from Maths)

4.How could you use at home or out of school what you learned today in your Technology lesson? (eg baking a cake, making a model aeroplane)

5.Please add anything else about today's Technology lesson you would like to tell us.

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