1997

Getting started in technology and enterprise : case studies in primary and secondary schools

Jack Bana

Lorraine Kershaw

Edith Cowan University

Copyright Warning

Getting Started in Technology and Enterprise

Case Studies in Primary and Secondary Schools

Edited by

Jack Bana
Lorraine Kershaw

MASTEC Monograph Series

Getting Started in Technology and Enterprise

Case Studies in Primary and Secondary Schools

Editors

Jack Bana

Lorraine Kershaw

MASTEC Monograph Series No. 6

Published by

MASTEC — Mathematics, Science & Technology Education Centre
Edith Cowan University
Perth, Western Australia

ISBN 0-7298-0361-9
ISSN 1324-3551

Cover Design

Peter Browne

Design and Desktop Publishing

Kylie Luca & Russell Miller

Graphics

Yvonne Gilbert

Acknowledgments

Staff, students and parents of the five participating schools
Local communities
Tertiary facilitators for the project
NPDP Technology and Enterprise Management Committee
Department of Employment, Education, Training and Youth Affairs

Table of Contents

CHAPTER ONE Introduction 1

Project Background 1

Professional Development Program 2

CHAPTER TWO Starting from Scratch: Introducing Technology and Enterprise at Safety Bay Primary School 5

The School 5

The Ambition for Technology and Enterprise 6

The Reality 6

What Happened? 7

Teachers' Responses to their Experiences Throughout the Year 13

Teachers' Ideas about Technology and Enterprise over the Year 14

Summary of the Outcomes of the Project 16

Recommendations 18

CHAPTER THREE Primary Technology: Keep it Simple — The Grovelands Experience 21

The School 21

The Teachers 21

Aims of the Program 22

The Program 22

Getting Started 23

The Technology Task Ideas 23

The Year in Review 23

Discussion 29

Conclusion 29

References 30

CHAPTER FOUR Approaches to Integrating and Assessing Technology and Enterprise: Ballajura Community College 31

The School 31

The Technology and Enterprise Program 32

A New Report Format 39

Planning for the Future 39

Conclusions 40

CHAPTER FIVE Introducing Technology and Enterprise in an Isolated Location: Paraburdoo District High School 43

The School 43

The Staff 44

The Project 44

Evaluation of the Project 50

Summary 52

CHAPTER SIX Technology and Enterprise at St Brigid's College: A First Attempt 53

The School 53

The Teachers 53

Project Context and Goals 54

The Project and Design Brief 56

Teachers' Reactions to the Activity 58

Students' Reactions to the Activity 60

Conclusions 62

CHAPTER SEVEN Outcomes and Recommendations 63

Outcomes 63

Recommendations 65

ABOUT THE AUTHORS 67

CHAPTER ONE

Introduction

Jack Bana and Lorraine Kershaw

This monograph describes the experiences of five Western Australian Schools, which were involved in a year-long school-based professional development program during 1996 in the Technology and Enterprise Learning Area. The program was part of a larger Technology and Enterprise project, which had been funded by the Federal Department of Employment, Education, Training and Youth Affairs (DEETYA), as part of a National Professional Development Program (NPDP).

Project Background

The Technology and Enterprise Management Committee was first established in 1994, the first year of a funding triennium for NPDP projects, to coordinate and undertake the activities of a project titled *Technology and Enterprise: Exploring the Student Outcome Statements* This project, as one of many projects involved in a wide range of professional development activities for teachers, was responsible to the WA Cross-Sectorial Consortium — the group formed to manage all NPDP projects in Western Australia.

In 1996, the Technology and Enterprise Management Committee consisted of representatives from seven professional associations — Agricultural Educator's Association of WA, Australian Teachers of Media, Business Educators of WA, Design and Technology Teachers' Association, Educational Computing Association of WA, Home Economics Institute of Australia (WA Division) and the Primary Technology Education Association of WA; together with representatives from the Catholic Education Office, the Education Department of Western Australia, and the Vocational Education Department of Edith Cowan University. The project was administered and managed by the Mathematics, Science and Technology Education Centre (MASTEC) of Edith Cowan University, while the day-to-day activities were coordinated by a project officer. The four major components of the project were:

- The development of an interactive multimedia package;
- the production of a resource bank of teacher materials;

- a two-day conference; and
- a school-based professional development program.

Professional Development Program

The aim of the school-based professional development program was to provide professional support for a limited number of schools to increase teachers' awareness of *A Statement on Technology for Australian Schools* and to explore the use of Student Outcome Statements through a range of activities designed by schools for their specific needs. In addition, an intention of the project was to develop a number of supportive networks by liaising with the Project team, by establishing links with tertiary institutions, and by facilitating the sharing of experiences among participating schools and other teachers.

Interested schools were invited to submit an application for participation in this project by providing details on:

- the proposed level of involvement of the principal, deputy and teachers;
- the type of resourcing proposed for the school coordinator;
- plans for ongoing professional development of participating teachers; and
- the level of knowledge and use of Student Outcome Statements in the Technology and Enterprise Learning Area by the coordinator and teachers.

In addition it was expected that:

- school coordinators would be responsible for assisting other staff members in the project ;
- tertiary facilitators would assist coordinators with their tasks;
- schools would make a reasonable commitment of time for the coordinator and provide other resources; and
- limited teacher relief funds would be available from the project.

Five schools were selected — two government primary schools, a government community college, a country district high school and an independent secondary school. They were Grovelands Primary School,

Safety Bay Primary School, Ballajura Community College, Paraburdoo District High School and St Brigid's College, respectively.

An action research model was adopted where the school coordinator assisted teachers in the planning, implementation and reflective phases of the program, by responding to the needs of the participating teachers as determined by them. The tertiary facilitator's role was an advisory one, where support was provided for the school and coordinator upon request. This took the form of limited professional development at the school, resource suggestions, and ways in which school selected activities could embrace ideas in the Technology and Enterprise Learning Area.

The establishment of supportive networks and the professional development of teachers were facilitated in the following ways.

1. An initial planning meeting was held for the tertiary facilitators and the Project Management Committee.

2. A one-day seminar was attended by school coordinators, the principals' representatives, facilitators and the management committee representatives. It focussed on the learning area, action research ideas, the background of significant features of each school, and formulation of initial project plans.

3. Three half-day workshops were held throughout the year for coordinators, facilitators and the management committee representatives. The purpose of these workshops was to reflect on progress, share ideas and plan future activities.

4. Coordinators and facilitators made presentations at the Technology and Enterprise Conference held in September, 1996, to share experiences with other teachers.

5. E-mail facilities were established at schools for coordinators to communicate with each other, and facilitators; and in the case of Paraburdoo District High School, with design art technology education students from Edith Cowan University.

6. Frequent informal contact occurred among coordinators, facilitators and the project officer, including school visits by the facilitators and the project officer. The coordinator at Paraburdoo District High School also visited some of the participating metropolitan schools.

The following chapters describe in some detail the experiences of each participating school. Of special interest are the very different

teaching/learning climates of each school and the ways in which teachers responded to and became involved in the program. For example, one of the high schools, having already adopted a cross-curricula approach to their technology and enterprise teaching, explored issues of assessment. Another high school, having no school program in this learning area initially, set about determining appropriate content of a very practical nature and developed activities leading to the provision of a much needed facility for all students at the school to use.

The types of activities chosen by teachers varied greatly. Some required the cooperation of the whole school, others were undertaken at home with the help of parents, while some became part of the existing curriculum.

Some of the factors impacting upon the successful implementation of this learning area are explained. These include the level of resourcing, the time made available for coordinator support and the professional development of teachers, and the enthusiasm and interest of the children and teachers in the activities.

Finally, in this reflective phase of the project, it can be seen that an action research model was a particularly useful framework for schools to develop and implement their professional development programs. Goals of different kinds and purposes were set and achieved, yet programs were able to be sufficiently flexible to respond to continually changing outcomes and needs.

CHAPTER TWO

Starting from Scratch: Introducing Technology and Enterprise at Safety Bay Primary School

Jan Ackroyd and Léonie J. Rennie

This chapter describes the experiences of teachers in a primary school who, with little in the way of resources, managed to introduce Technology and Enterprise during 1996. The chapter begins with a description of the school and its ambitions for Technology and Enterprise, explains in some detail how Technology and Enterprise was introduced throughout the school and documents teachers' responses to their efforts. The chapter evaluates the success of the project and concludes with recommendations which may be helpful for other primary schools starting out with Technology and Enterprise.

The School

Safety Bay Primary School was established in 1942 and has a very diverse clientele. About 30 percent of families are single parent, but there are also wealthy families. The school is described as "just above PSP (Priority Schools Program) level". There are 28 teachers, around 500 children (K-7) and two Education Support Units on the site. There are approximately 75 children in the school classified as being at risk of failure due to a lack of literacy skills. During 1996, the school gave priority to pastoral care, language with an emphasis on grammar, and catching and throwing in Physical Education. There was also a plan to introduce the Technology and Enterprise Learning Area and to increase teachers' familiarity with computers.

Safety Bay Primary School joined the NPDP project because of the move to make Technology and Enterprise a priority in the school. This move was partly precipitated by the transfer of Jan Ackroyd into the school because she had a great deal of experience in teaching Technology and Enterprise using the draft Student Outcome Statements, and she was willing to be the school coordinator for the project. The school hoped that participation in the project would facilitate the introduction of teachers to the Technology and Enterprise Learning Area, and the Student Outcome Statements, both of which were new to teachers. The school's main needs in the area were perceived to be money for

Technology and Enterprise, a stock of recyclable items and a storage area and system for organising them, and awareness-raising professional development for teachers. The role of the NPDP facilitator, Léonie Rennie, was expected to be a "sounding board", and to assist with professional development for teachers early in the year.

The Ambition for Technology and Enterprise

At the beginning of the year, the school Technology and Enterprise coordinator and the principal, Bruce Blay, reported that their overall ambition for Technology and Enterprise was to develop a whole school plan for 1997 in which Technology and Enterprise projects were identified and were totally integrated with other subject areas. In working towards this aim, during 1996, the coordinator planned to introduce Technology and Enterprise through the science program, *Primary Investigations*, and to "twist" the activities to give a "technological flavour". She envisaged a major Technology and Enterprise activity each term which could involve all classes and lead to a "fun day" at the school. She hoped that teachers' participation in these activities would show them how easy it can be to integrate Technology and Enterprise with other subjects.

The Reality

Despite considerable enthusiasm and positive thinking about the introduction of Technology and Enterprise at Safety Bay Primary School, there was little in the way of human and material resources.

Human Resources

Originally, the coordinator was assigned 0.2 time release as a key teacher and it was hoped that much of this time could be spent supporting staff in the Technology and Enterprise project. However, this time rapidly became consumed by the STAR (Students At Risk) program, for which she was responsible. Nevertheless, she persisted with her efforts on the Technology and Enterprise front and managed to squeeze some time out of staff meetings, and so on, in order to keep things moving along.

Technology and Enterprise was a new area for most teachers and even if they were aware that the school had made it a priority, they did not know what was involved or what they might be expected to do. Although willing, teachers generally felt uncertain about the introduction of Technology and Enterprise. There was also the possibility that the coordinator, also the "new chum" in the school, would be regarded with some suspicion by the established staff, as

someone wishing to implement change without understanding, or giving consideration to, the particular circumstances and needs of the school.

Material Resources

A big challenge was the lack of resources. There was a definite link perceived between technology and computers, and although there was a budget allocated for computer-related expenses, there was no separate budget committed for Technology and Enterprise. There was no bank of tools and little in the way of a stockpile of materials for construction activities. The school had purchased *Primary Investigations*, a course for science which had a technology strand and proved to be a source of ideas for some teachers. Apart from this, there were only one or two general library books which could be helpful. The Parents and Citizens' Association was supportive of the school and it was planned to approach them for assistance.

What Happened?

Despite the limited resources, the Technology and Enterprise program was quickly under way, but with careful planning. An initial problem, of course, was that teachers had already prepared their program for first term at least, and usually this did not include Technology and Enterprise because this was a new learning area for some teachers. A priority was to ensure that teachers were fully aware of the plans for Technology and Enterprise, and that they felt both confident and willing to take them on board and become involved with the new learning area. This required firstly, that teachers had an understanding of what Technology and Enterprise was, in terms of the learning area statement; secondly, that teachers felt there was support and encouragement for their involvement; and thirdly, that there was access to at least some resources for the activities.

Introducing the Technology and Enterprise Learning Area

The first step was to use a staff meeting in February to explain both the school's involvement in the NPDP project and to introduce the Technology and Enterprise learning area to the teachers. The project officer, and the tertiary facilitator for the school, attended the staff meeting. The project officer introduced the project, the facilitator ran a short inservice session aimed at developing and broadening teachers' understanding of technology by documenting and sharing their ideas. There was a range of interesting ideas about technology held by the teachers and after discussing and sharing their ideas, many teachers were surprised at how much they already knew. This meeting also served to introduce the facilitator so that in her subsequent visits to the

school, teachers would recognise her, and hopefully feel free to share their experiences.

Introducing Technology and Enterprise through Whole School Activities

Following the first inservice experience, there was little opportunity for formal professional development. With the large amount of the school coordinator's time committed to the STAR program for students with learning difficulties, little was left for planning and offering professional development. It was recognised that if teachers were expected to introduce something new, they should be offered help and support, even if they couldn't see the need for it at that stage. Inservice opportunities were "created" by the coordinator giving information during morning tea, and also taking time in staff meetings.

She introduced the idea of one Technology and Enterprise activity each term for all classes. These activities were chosen carefully, because it was important that teachers be able to incorporate them into their normal class work if possible. Also, by culminating the activity with some whole-school event, there would be the opportunity for all children to feel involved. To assist teachers and children in planning and carrying out the activity, she prepared program planning outline sheets as shown in Figure 1, some lesson planning sheets, student planning sheets as in Figure 2 and evaluation checklists, and made copies available for those teachers who wanted them. Some teachers made use of these materials, particularly the student sheets. The three activities chosen for the first three terms were concerned with hats, houses and toys.

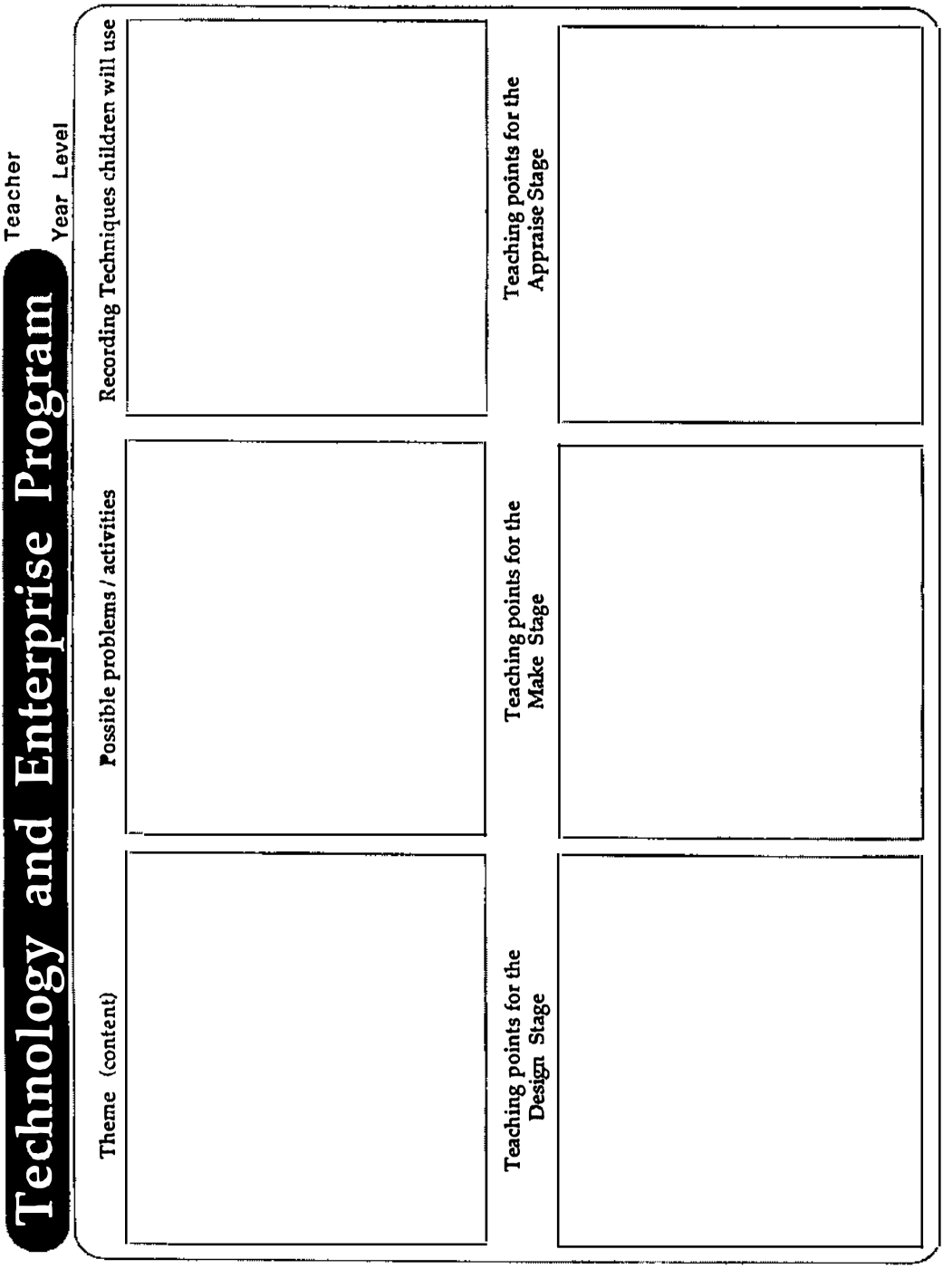


Figure 1: Program planning outline sheet

(Jan Ackroyd, Safety Bay Primary School)

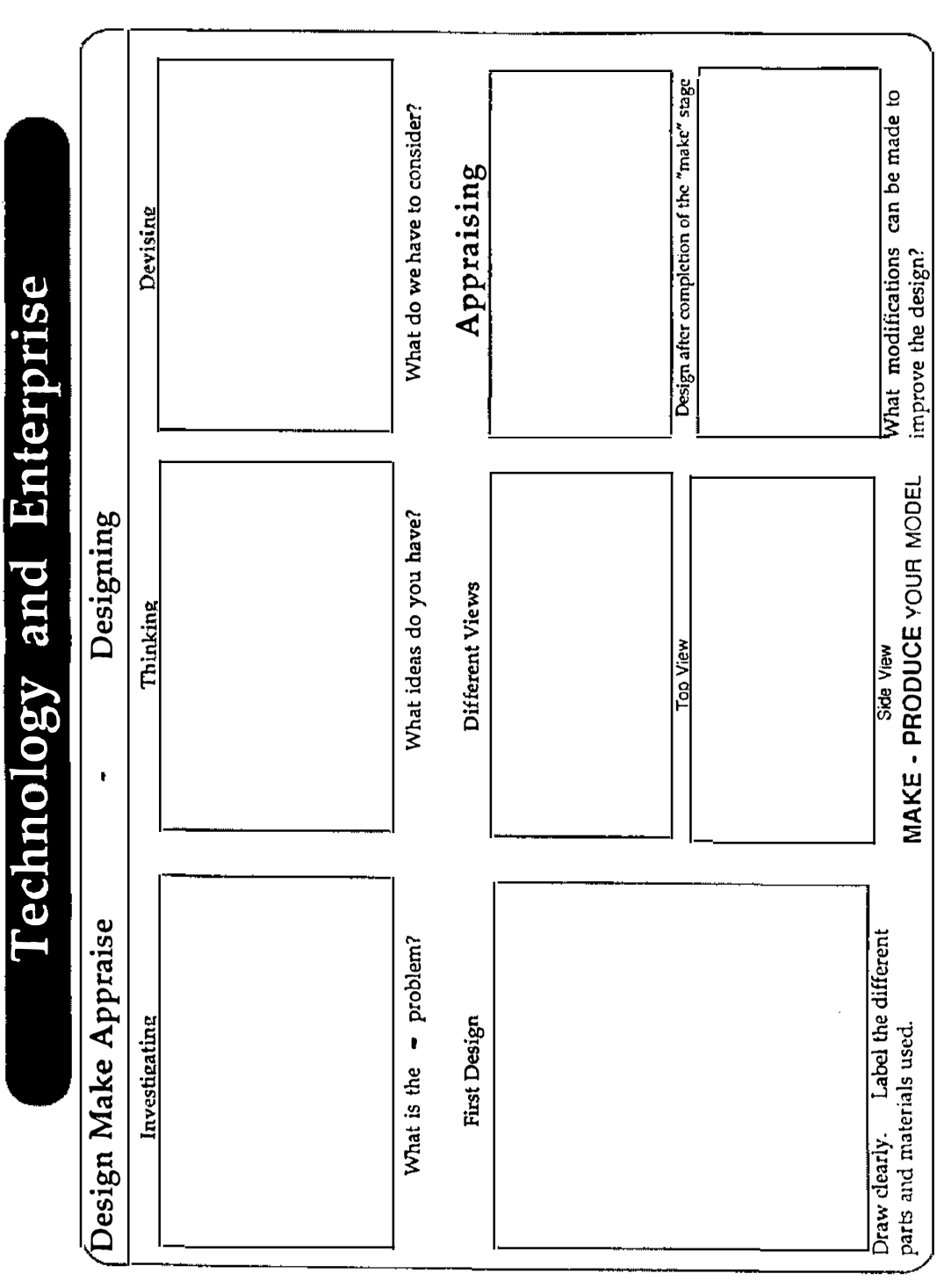


Figure 2: General student planning sheet

(Jan Ackroyd, Safety Bay Primary School)

Here's to Hats took advantage of the usual Easter activities by having children design, make and appraise (DMA) an Easter hat. If they wished, teachers adapted the activity according to their own plans. For example, one class used a "Bananas in Pyjamas" theme, while another did Easter eggs instead. The hat activity culminated in a wonderful parade before the whole school. Children reacted very positively, helping teachers decide to try another activity.

Here's to Houses was the second-term activity. One of the Year 5 teachers spent a considerable time going through the *Primary Investigations* materials and other resources and found that the houses topic could be fitted in at every year level. The school's gardener organised small concrete blocks to be set in 500 mL margarine containers, each with two popsticks inserted vertically in the sides of the block. These were set in one plane for lower primary children, and parallel for older children, facilitating the building of a two, or three-dimensional building, respectively. Enough concrete blocks were prepared for each child to have one, and the resulting houses revealed some very diverse and creative designs. The facilitator visited the school at about this time, and in talking with teachers, found them very willing to integrate the activity into their current theme, although occasionally teachers were unable to do this.

It's Time for Toys was the third whole-school activity. During a staff meeting early in third term, a brainstorming session resulted in the choice of toys as a topic which was inclusive of nearly all the suggestions made. For example, one teacher was planning to build mousetrap racers, another wanted to make musical instruments, and these fitted under the theme of toys. The Big Book Series called *Realizations* had one book about toys to which teachers could refer and other resources were purchased to support the topic. The student planning sheet for the toy activity is shown in Figure 3.

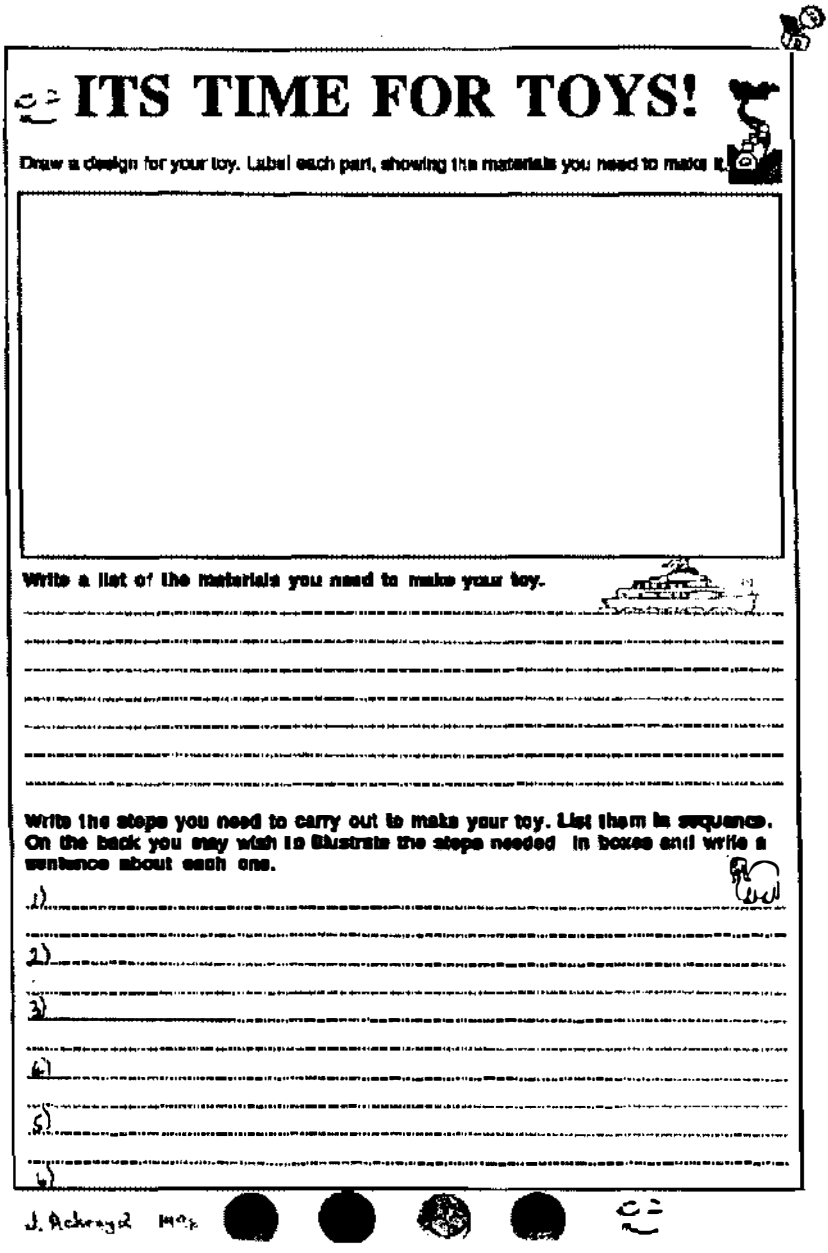


Figure 3: Student planning sheet for 'Toys' topic

Finding Resources

The school had assigned a budget for computing and technology, so $500 was taken out of that to form a separate budget for Technology and Enterprise. This became the major source of funding for the school's efforts in the learning area and was used to purchase consumables, such as masking tape and other joining materials. An approach to the P & C Association was successful in obtaining funds to buy the *Realization* Big

Books for junior topics, and a commitment was made to purchase the middle and upper primary topics over the next two years.

Recyclable, "junk" materials for building were collected as they were required, mainly brought to the school by children — an activity which quickly emphasised the lack of storage space. Parent helpers were enlisted to help sort the materials and store them on shelves in an accessible area in A-block. The large indoor area between the classrooms in A-block was used extensively by the teachers whose classrooms bordered it to assist in the storage of work in progress. In fact A-block proved to be a very positive resource for the whole project, as it was ideal for parades or displays of the Technology and Enterprise products.

An effort was made to involve parents in the children's Technology and Enterprise activities. Apart from seeing what the child was doing, parents could be a source of ideas and perhaps provide some materials not available at school. This gave children access to a greater range of resources, as well as ideas and assistance.

Teachers' Responses to their Experiences Throughout the Year

The teachers' participation and their experiences in Technology and Enterprise was an important part of the program. Near the end of the year, a short questionnaire was completed by staff during a meeting after school. The questionnaire focused on staff reception to the three whole-school activities and on teachers' own ideas about Technology and Enterprise, and also on what difficulties or barriers they thought needed to be overcome in order to include it in their 1997 programs.

Participation in the Activities

Nearly all teachers undertook all of the activities (17 out of 20 responding teachers), and several did other ones as well. Most teachers (half to three-quarters) integrated the activities into their class work. The activities were regarded as successful, on average, but responses ranged from "not very successful" to "fabulous". Houses seemed to be a little more accepted than Hats and Toys, perhaps because all children were provided with the basic framework for the house. Another teacher responded to the questionnaire from the computer studies point of view, reporting that several activities used were based on available programs which were integrated with class work and found to work very successfully.

Best Thing about the Activities

The most common comment was that the children enjoyed the activities, they were found to be motivating and maintained a high level of interest. Also appreciated were the opportunities for integrating the activities into other subject areas. Teachers named art, maths, science, social studies and music, and especially language giving "great opportunities for writing". The use of skills like problem-solving, making and creativity, were suggested as advantages of the Technology and Enterprise approach, and some teachers commented on the originality of the children's designs and the variety of results in their class.

Most Difficult Thing about the Activities

By far the most common difficulty experienced by teachers was the time required to complete the construction of models. Teachers who did not integrate the activity with other work were particularly concerned about the time commitment. Another major problem perceived was the lack of equipment and other resources, especially if children had particular designs they wanted to follow and appropriate materials weren't available. Some teachers felt that children's designs were sometimes too ambitious and they lacked the skills (e.g. joining materials, using equipment) to make their designs. Some teachers also noted that children were frequently keen to do the "making" part of the DMA process, but were not willing to do the planning and recording of their activities, especially if these required writing! Some teachers, including the coordinator, were using oral reports as an alternative to written ways of evaluating.

Parent involvement was found to be a two-edged sword. Supportive parents helped to provide materials, some helped in the classroom, and it was great to have them involved at home. However, sometimes parents were too enthusiastic about helping their children to make their models, doing a considerable part of the construction. Children made comparisons between each other's products, and those which clearly had lots of parent help often caused negative reactions from children who had worked alone with limited equipment and materials.

Teachers' Ideas about Technology and Enterprise over the Year

Teachers were asked: At the beginning of the year, how did you feel about teaching Technology and Enterprise ?

Not surprisingly, teachers' initial ideas about technology varied widely, ranging from "nervous" to "confident"; "not sure what was expected" to "had already programmed it"; "didn't worry me except it

was another thing to be fitted in" to "felt it was imposed without warning". In summary, several teachers were quite concerned about the prospect, some were ambivalent, and several were quite confident.

A follow-up question asked: Have your own feelings/ideas about teaching Technology and Enterprise changed during the year? If so, please say in what way, and try to say what caused the change.

Of the 20 teachers, two omitted the question, and four reported no change. The rest gave varied, but generally supportive answers. Some teachers had very positive experiences during the year. For example, a teacher who wrote "confused" in answer to the previous question, wrote "Definitely! By doing it I became more confident and realised how motivating and appropriate the Technology and Enterprise is for children of all abilities." Another, initially nervous, wrote "Yes, I feel that when it is attempted properly it is a true integration tool. Fits into current program very well. It is not something extra, just needs a little more thought into the planning/designing/recording of the Technology and Enterprise component". Several teachers commented that they thought the whole-school approach worked well, but a couple of others found that the suggested activities didn't fit their program and they would prefer to work it in at times more convenient to them.

Benefits and Difficulties for the Future

To try to get some idea of what teachers perceived as benefits of Technology and Enterprise and barriers to the further introduction of technology, they were asked: For next year, if Technology and Enterprise is to be included in your own program, what do you see as the main benefits and difficulties?

Ten teachers mentioned benefits, focusing particularly on the opportunities for children's development of skills, and the opportunities for integration, especially in language, art and science. One teacher wrote, "Children can use their own ideas, they are motivated. There is no sense of failure." It was noted that often children who were not academically successful were good with their hands and gained success in the model-making activities. Thus these were activities which could build children's self-esteem, particularly if they helped to plan the activities.

Fifteen teachers wrote about the difficulties involved, and these were consistent with those mentioned for the whole-school activities. Two themes were paramount. First, the time required to complete the construction tasks and the consequent neglect of other areas of the curriculum was a concern of many teachers. Second, more resources, materials and equipment were required. A related concern was the need

for storage space, especially for incomplete models and work in progress. Teachers of very young classes, or in the Educational Support Units, found that these children lacked skills and needed considerable assistance, often one-on-one help. Another mentioned that teachers were accountable to the community for teaching the three Rs, but that the community needs to recognise that not all learning takes place by reading, writing and arithmetic.

Summary of the Outcomes of the Project

Overall, the teachers' responses to the introduction of Technology and Enterprise were positive. All classroom teachers participated in at least two of the activities, and most did all three. However, while some felt their experiences had been very positive (although they still had some concerns about time and equipment), two or three others remained cautious. The varied reactions from teachers is not a surprise, given their different outlooks at the beginning of the year.

While some teachers commented on children's lack of skills, others noted the improvement evident over the year. Considerable practice is required before all children can tackle and complete DMA tasks with confidence. If teachers are able to plan exercises which assist children to develop skills and sequence their construction activities, this problem will soon disappear. Further, those teachers whose classes did a lot of design work, found that the designs children made became more practical as they came to appreciate the level of skill they possessed. By the end of the year, children's models bore a great resemblance to their plans!

During a visit by the facilitator in May, the principal stated that he was "terrifically pleased", suggesting that Technology and Enterprise was being spread throughout the school. Somewhat to the coordinator's indignation, he likened her to a mother hen, gently pushing here and there to move people along. He felt that guiding without imposing was crucial to having teachers pick up ideas and run with them. At the end of the year, he was delighted at how the project had turned out, and was optimistic for the following year. He thought that the whole-school activities had produced some great results, and that some teachers had taken additional opportunities to include Technology and Enterprise. For example, the Year 7s had made pickled onions as a fund raising activity, thus allowing the whole process of Technology and Enterprise to be exploited.

The principal recognised that the introduction of something new was a slow process. He saw the DMA process as central to what was already happening in the school, and the key to the successful introduction of Technology and Enterprise as a learning area integrated with other

learning areas: "The idea to me is that we are getting the message to the kids that if they are going to do anything, they actually have to plan it, do it, and appraise it at the end, and that fits with anything, regardless of whether it is Technology and Enterprise or anything else. It can be a piece of their writing, they plan it before they write, they appraise it unconsciously at the end when they are checking it. I mean all their educational things fit that way." Thus, at Safety Bay Primary School, Technology and Enterprise is viewed as a learning area with a legitimate place in the curriculum and one which has the potential to be a valuable addition to the curriculum.

Successful introduction of Technology and Enterprise in the future will require a careful look at the issues of time and resources. The experiences of those teachers who were able to integrate Technology and Enterprise into their program, suggest that the time problem might best be tackled by integration, especially for teachers who work with a thematic approach. With truly integrated planning, the Technology and Enterprise activities can be used as a focus in the classroom, rather than as "an extra". For example, written language can be taken from designing, planning, and sequencing stages of the activity; craft and art are involved in the making; oral language can be involved in appraisal and reporting.

The concern about resources is a more difficult one to alleviate. A designated budget for Technology and Enterprise will provide for consumables (especially joining materials) and begin to build up other resources, such as books, tools and other equipment in the school. Teachers in some of the older classrooms with limited space will continue to find the storage of materials and equipment a major challenge.

To maintain the focus on Technology and Enterprise during 1997, some funds have already been directed to establishing a trolley with tools and other equipment for each of the three classroom blocks. This should be a valuable and accessible resource for teachers. The budget would be maintained, possibly increased, to assist in the building of resources. In 1997, the coordinator's role will also change. Instead of having her own class and also looking after the students with learning difficulties she will work with this STAR program in the morning. Then in the afternoons she will focus on oral literacy through drama — a school priority for 1997. She feels that drama has great potential to be given "the technological twist"!

Recommendations

The following recommendations have been developed on the basis of the teachers' and the principal's reactions to the project throughout the year, and their written and verbal responses and suggestions given to the coordinator and facilitator. The recommendations outline the things which school administrators and teachers might consider to put into place before introducing Technology and Enterprise.

Leadership

- A *coordinator/teacher leader* for the project is required to provide staff support, be responsible for resources and document the project. The coordinator must be given adequate time release to do this job effectively.

- Further, whole-school introduction of Technology and Enterprise requires *whole-school commitment*, in that teachers are willing to give it a go. Ideally the District (or Central) Office will assist with staff support.

Resources

- *Time release* is needed for the coordinator to provide staff support, but also for the staff to attend inservice and workshops for planning.

- A minimum amount of *materials and equipment,* including resources and consumables are required, and a procedure established for building up a supply of construction materials in the classroom itself. Some library resources for teaching ideas are required. A starting plan might be to purchase a resource kit of simple card activities for each group level.

- A big problem is *storage space* for ongoing projects. A desirable situation would be to have space for tool storage, a working room, and easy access to materials/tools/equipment by each block of classrooms.

- *Money* is always an issue! A dedicated budget for consumables with enough money to purchase additional new resources each year. If Technology and Enterprise is designated a priority, then money would be allocated for materials/ consumables/ tools and teachers' resources for ideas, and time for inservicing.

Ideas for Program Planning, Evaluation and Recording

- For a staff new to Technology and Enterprise, we recommend "*give it a go*". Just *use the DMA focus initially* without an emphasis on evaluating or recording, just to get a feel for Technology and Enterprise and find out what it is all about. (Worry about the other strands and the Student Outcome Statements later, when teachers have overcome their concerns about the technology process.) The coordinator will need to provide considerable support to help teachers work through these first attempts and then to add evaluation and recording. Even at this early stage, Technology and Enterprise can be integrated with other subject areas, with integration using Technology and Enterprise as the focus and the ultimate aim.

- A whole-school *focus on one topic* can be used in the beginning to encourage teachers to be involved and to share ideas. Later, teachers will begin to do their own plans.

- Most importantly, the first year is one of exploring the learning area of Technology and Enterprise and teachers and children should *have fun*.

CHAPTER THREE

Primary Technology: Keep it Simple — The Grovelands Experience

Trudi Summers and Judith Cousins

This chapter reports on a project which aimed to involve all the teachers in a primary school in implementing some technology tasks in their classrooms. The provision of ideas and resources by the coordinator for teachers, the lack of pressure on them to participate, and the involvement of parents proved to be very successful strategies

The School

Grovelands Primary School, situated in the southern part of the Perth Metropolitan area, is in a low socio-economic area consisting of Government housing estates. For a number of years the school was classified as a 'priority' school, and had just had this classification removed. In 1996 the school's population was 330 children in Years 3 to 7, placed in eleven classes, with twelve full-time teachers and one part-time teacher.

The Teachers

The school principal was keen for the teachers to begin to implement some aspects of technology education and was supportive of the plan and ideas of the coordinator. Other staff members were less enthusiastic. The teachers' industrial dispute of 1995 and the lack of parental support for school initiatives, had resulted in a school climate where teachers were not favourably disposed towards change, or projects were seen as extra work. With this in mind, the focus of the NPDP project was to provide teachers with technology tasks which were planned by the coordinator and could be done by the children, often out of school time. The coordinator noted that in this way, there was no pressure on fellow teachers to try and implement this program within their classrooms with their already overburdened timetables.

The coordinator was also Acting Deputy Principal at Grovelands during Terms 1 and 2 and had to include her coordination role in this project as part of her administration duties. In Terms 3 and 4, she had 40 minutes

per week allocated for coordination. A budget of $1000 was allocated by the school to the project for 1996 — the first time any funding had been provided for technology, apart from some computer hardware and software.

Aims of the Program

The Principal stated that by the conclusion of the project she hoped all teachers at the school would have an awareness of the learning area of Technology and Enterprise, and that they would feel confident enough to implement some simple technology tasks in their classrooms.

The coordinator wanted teachers to start to include some technology tasks into their programs and also to begin to understand the structure of the Technology and Enterprise Student Outcome Statements, and how they could be used for planning, recording, assessing and reporting purposes.

The Program

The program prepared by the coordinator consisted of one project per term. All the children at the school were given information about each project, but it was not compulsory for them to take part. The projects were:

- Term 1: Making a gravity screw from recycled materials;
- Term 2: Building a steam roller;
- Term 3: Creating a ground craft powered by a rubber band; and
- Term 4: Designing a bin that would encourage children to put their rubbish in.

Two additional projects — construction of a haunted house and the design of a new Australian flag — were also undertaken and these will be discussed later in the chapter.

The implementation of the program required the coordinator to give the teachers some background knowledge about each of the projects, provide information hand-outs for the students, keep the momentum going through classroom visits to talk about the projects, and organise participation certificates for those students who completed a project.

Getting Started

The initial staff meeting to discuss the overall project did not arouse any noticeable interest in most of the teachers. The coordinator stressed that it was possible for them to have minimal involvement, as she would be doing all the planning and organising, but she would like them to discuss the projects with the children in their classes and encourage them to participate.

The visit by the project officer and facilitator to explain the overall NPDP Project, was reasonably well received, though it was apparent that a number of teachers knew little about this new learning area of Technology and Enterprise.

The Technology Task Ideas

The ideas for the technology tasks came from a number of sources, mainly art/craft books, which explained how to build simple toys; and from some technology resource books, such as Minton and Minton (1987), *Teaching Technology to Children.*

During the year ideas for further projects evolved from other learning areas, such as Social Studies (e.g. making a new Australian flag), problems noted around the school (e.g. need for a canteen sign) and from advertised competitions (e.g. Haunted House competition at Scitech Discovery Centre). These topics were well matched with Harriman (1996, p.147) who stated,

Finding interesting starting points for technology activities can motivate students while, at the same time, providing a focus for their thinking. These may in lude:

- students' interests . . .
- solving a real problem . . .
- external activity or events . . .

The Year in Review

Term 1

Term 1 saw the initiation of the overall project and much was achieved. Teachers were introduced to the Technology and Enterprise learning area through staff meetings, the 'gravity screw' project was planned, and all teachers and children received their information sheets explaining what had to be done. A newsletter was written to parents asking for

donations of items to be used for technology tasks, money from a raffle was used for some teacher resource books which were displayed in the staffroom, and a storeroom was designated for storage of technology materials.

As materials were donated they were sorted and set up in the technology storeroom where they were available for all teachers to access. Organising donated materials and keeping the storeroom in order was one of the on-going tasks for the coordinator throughout the year. A number of requests were made to local companies asking for materials such as plastic bottles, popsticks etc. These requests were all successful and resulted in a number of useful items being available for model building.

The 'gravity screw' project was enthusiastically attempted by a number of children and their constructions were displayed in the library. The local community newspaper became aware of the project and an article and photograph, featuring children from Grovelands with their models, gave the school some very positive publicity. One such model is pictured in Figure 1.

Figure 1: An example of a gravity screw

Term 2

The project for Term 2 was to build a steam roller, The teachers and children were given an instruction sheet which outlined one construction method and suggested the materials to use. Again there was a good response from the children and a display of models was presented at the school assembly and later set up in the library. Each teacher was given a technology resource book as an incentive to try some simple activities within their classrooms. A professional development session by Arborland Consultancy, which focused on how technology was used in the Aboriginal culture, was organised by the coordinator and attended by all teachers. This was well received. The coordinator also wrote a program for the Water Corporation and this initiative won a computer for the school.

The 'Haunted House' competition, organised by Scitech Discovery Centre, was advertised at the school and children from one Year 7 class decided to enter. Their class entry was judged as joint winner and Grovelands became the proud recipient of an IBM computer, with a range of accessories. The winning group was featured in *The West Australian* newspaper which stated the model was "complete with graveyard, spooky lights and strange noises". The model house is shown in Figure 2.

Figure 2: Model of a haunted house

Term 3

The project for Term 3 was to construct a rubber-band powered car. Again the teachers and children were provided with ideas on how to build this model, along with possible materials. However, this was just one of a number of projects which developed during this term. Staff meetings, which were held fortnightly, resulted in two other whole-school projects being undertaken. The first was to design a new Australian flag. This came about through work related to the Olympic Games and teachers readily saw the links to their current events programs and Social Studies work, plus integrating art skills in the final designing phase. Each class was given a sheet for the initial designing and children were asked to state why their design was the best. This was a development from the earlier projects, which had been quite structured. With the flag task the children had to consider what makes an interesting flag, what is the purpose of having a flag, and whether their flag met the criteria of being Australian. Interest in the flags was such that a number of classes selected the best design from among their members and then produced a class flag. Figure 3 shows the proforma for students to report on the flag project.

By this time the teachers had begun to show considerable interest in technology tasks. This appears to have been stirred by the children's enthusiasm and through parental support for the project work, much of which had been done at home. It was decided to have a monthly project, with each of the junior and senior classes working on different tasks. The coordinator decided on the projects and prepared the handouts for the children, then the teachers implemented the ideas in their classrooms. The coordinator believed that the success of these projects was because there was no preparation required by the teachers.

During this term a 'clubs' time was scheduled for an hour on Friday afternoons. Each teacher was a club leader and organised a range of different activities, many of which were Technology and Enterprise focused. Children undertook bridge building and other designing tasks. One group designed and made blankets which were donated to the Salvation Army. This venture was so successful that it was continued throughout Term 4, and was planned for at least two terms in 1997.

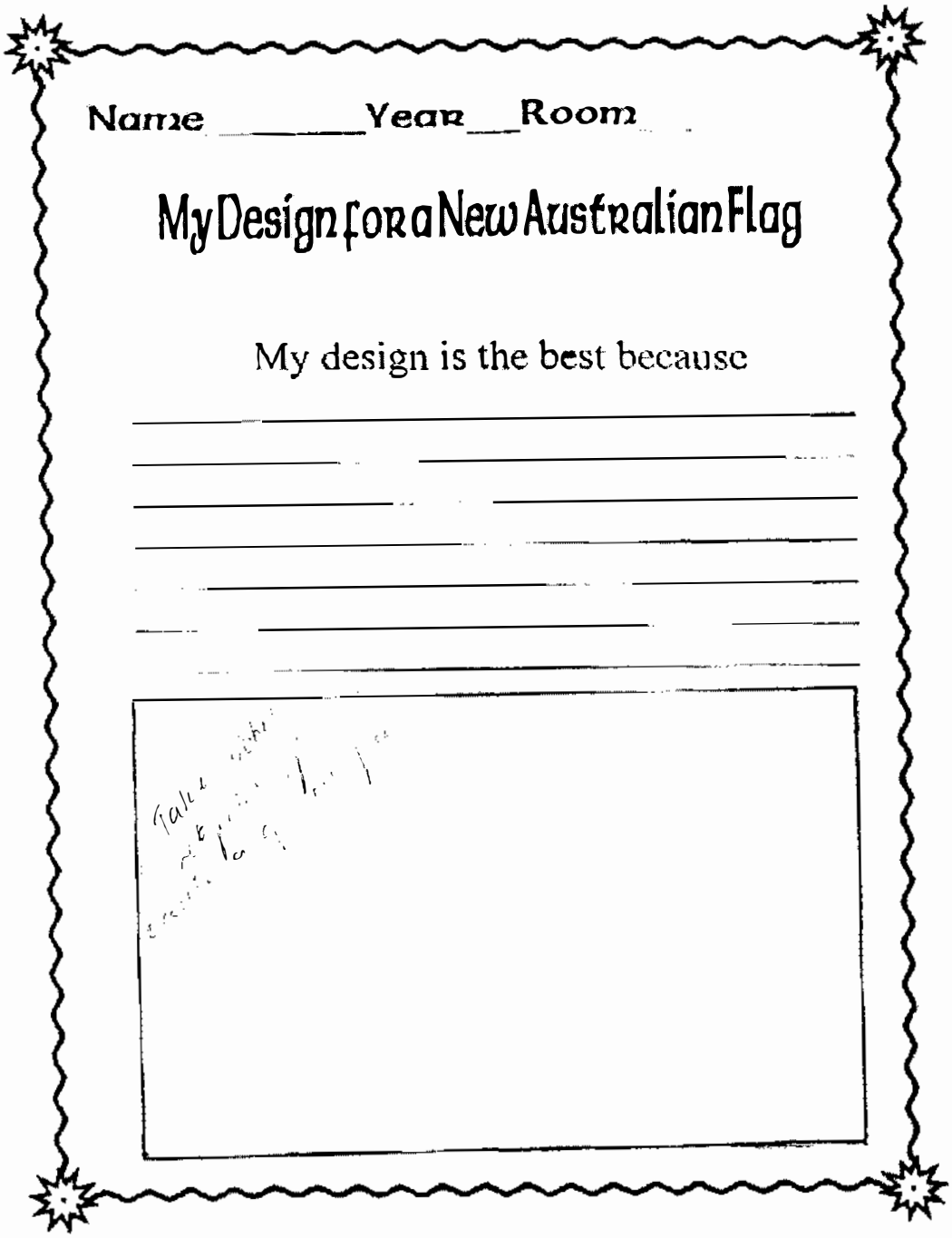
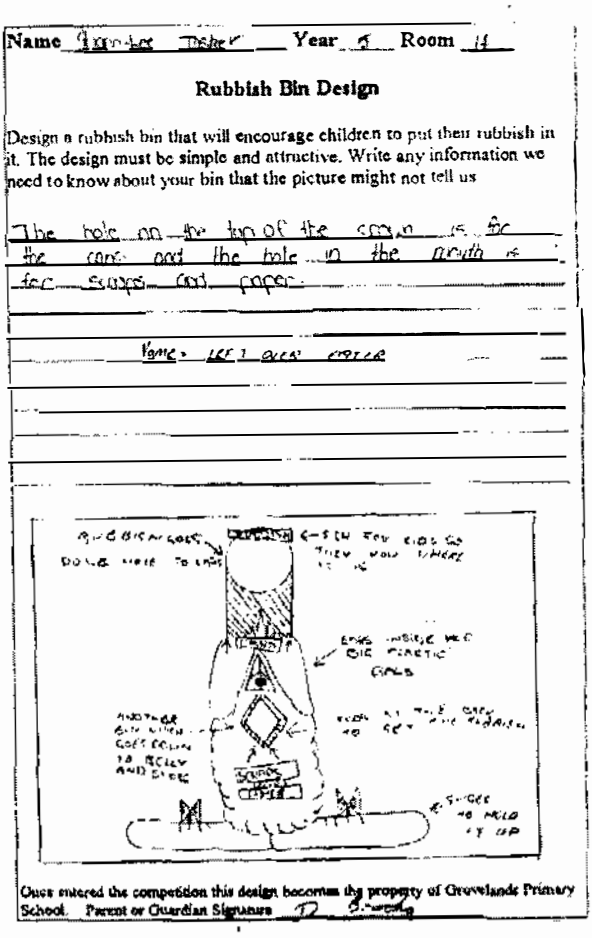


Figure 3: Proforma for reporting on flag design

Term 4

The major project for Term 4 was to design a rubbish bin that would encourage children to place their refuse in it. This again was a whole-school project. A wonderful incentive for this project was that funds were allocated to have the winning design professionally built. The aim was for the children to see that their ideas were of value and could actually be implemented.

Each year level was also given a different project to complete, in addition to the rubbish bin project, as part of Education Week activities. One of the worksheets is shown in Figure 4.



Name _____ Year 5 Room 14

Rubbish Bin Design

Design a rubbish bin that will encourage children to put their rubbish in it. The design must be simple and attractive. Write any information we need to know about your bin that the picture might not tell us

The hole on the top of the can is for the cans and the hole in the middle is for scraps and paper.

Name: [illegible]

Once entered the competition this design becomes the property of Grovelands Primary School. Parent or Guardian Signature _____

Figure 4: Example of worksheet

Discussion

The technology and enterprise project at Grovelands, which began in a climate of disinterest, developed throughout the year so that at the conclusion a number of teachers were involved and enthusiastic about including technology tasks as part of their classroom activities. The coordinator believes that the project was a success because teachers were treated like professionals and given inservicing and resourcing whilst being shown different ideas, working across the term with the projects.

Apart from the inclusion of technology tasks, either independently by the children, or under the guidance and direction of the teachers within their programs, the Technology and Enterprise Student Outcome Statements were discussed at staff meetings and the coordinator prepared record sheets, based on the Statements, for each teacher to use. These sheets showed each level and the matching strands and substrands, and gave teachers one way to record a child's progress in this learning area. It was hoped that these could be passed on to teachers the following year and thus a child's record would be ongoing.

Conclusion

The impetus to introduce some aspects of the Technology and Enterprise Student Outcome Statements into the curriculum at Grovelands was provided by the coordinator, whose personal expertise, enthusiasm and hard work resulted in a number of extremely interesting projects being completed. The process of providing teachers with the ideas and the materials, without imposing extra work or decision-making on them, proved to be a formula for success.

The coordinator has recently been selected by the Education Department of Western Australia to participate in the Technology in Schools project, *Innovations in the Classroom* in 1997. As an innovative teacher she will be granted $2000 for the implementation of a technology program.

Grovelands has made a start in implementing activities relevant to the Technology and Enterprise Learning Area. Teachers have ideas for projects which they have seen handled well by some children, so they realise the types of materials and equipment needed for construction activities and have commenced some early recording of children's abilities. The children have experienced some opportunities to try new and different project work, often in the home situation, which has had the effect of arousing some parental interest in school matters.

The initiatives which were undertaken in 1996 will provide the starting points for a broader and more in-depth development of the Technology and Enterprise learning area at Grovelands in the future. The simple approach taken here is a good example of how teachers can be introduced to new ideas in a way that is non-threatening and supportive.

References

Harriman, S. (1996). *Carrots, kites and traffic lights: Upper primary technology.* Melbourne: Curriculum Corporation.

Minton, G. & Minton, B. (1987). *Teaching technology to children.* Worcester: Davis Publications.

CHAPTER FOUR

Approaches to Integrating and Assessing Technology and Enterprise: Ballajura Community College

Helen Lydon and Paul Newhouse

This chapter reports on the Technology and Enterprise program implemented at Ballajura Community College in 1996. The program placed particular emphasis on assessment practices. The four technology staff were involved in an integrated program designed to address the Education Department of WA Student Outcome Statements. They had particular concerns with methods of assessment being used to fulfil the ideals of outcomes-based education.

The School

Ballajura Community College (BCC) is a new and developing secondary school in the north-eastern suburbs of Perth. It is one of three government secondary schools set up to implement a number of initiatives in education. The school selects its own staff. BCC's ethos centres around the provision of opportunities for students to develop understandings, skills and attitudes to enable them to be active citizens and whole-of-life learners. In this way the school is committed to encouraging students to become successful learners, so it adopts an integrated student-centred approach to all teaching and learning. This is demonstrated by practices such as:

- maintaining a flexible, caring and supportive learning environment through whole-school collaboration;
- using participative decision-making involving students, staff, parents and community;
- engaging in reflective practices and whole-of-life learning;
- developing responsible and accountable members of the school community;

- maintaining a healthy and safe environment; and
- promoting mutual respect, trust and recognition of individual worth.

The school included students in Years 7, 8 and 9 who were organised into home-rooms. Learning programs covered the eight national learning areas and embraced the state Student Outcome Statements (SOS). Integrated programs were presented in modules, usually of a term's duration. Teaching and learning in all learning areas was based on the identification of key learning outcomes with a special focus on literacy, numeracy and technology.

The Technology and Enterprise Program

In the Technology and Enterprise Learning Area the school adopted an integrated student-centred approach to learning programs designed to develop generic as well as specific skills related to Business Education, Information Technology (Computing), Food and Textiles Technology, and Materials Technology.

Students were engaged in Technology and Enterprise activities for three hours per week. For students in Years 7 and 8 this was organised in a half-day continuous morning block. In Year 9 students came to the centre for one hour before lunch and then a continuous afternoon block. This allowed for an integrated program within the school's Technology and Enterprise subjects. A framework of essential and specific skills that related to these subject areas was developed by the staff to assess student outcomes.

To facilitate implementation of the integrated program a range of strategies was used to involve staff. Detailed skill and project information was written by technology staff and distributed to home-room teachers; regular briefing for all staff was undertaken; collaborative planning occurred within the technology team; and home-room teachers attended regular planning sessions.

Years Seven and Eight

The program for the Year 7 and Year 8 groups was staffed with three specialist technology teachers and six generalist home-room teachers across four separate learning teams. Students came to the centre in one large group with a range of 150-180 students. The students were then organised into smaller groups so that each could work on a different program. In first term each group worked on a *Landcraft* project and a Healthy *Foods* project.

Landcraft and Healthy Foods Projects

The first project was the design and construction of a Landcraft, which involved a combination of Materials, Textiles, Design-Make-Appraise (DMA), and Business Processes. Students investigated, researched, designed, made and tested a wind-powered landcraft. The students completed three types of tasks: designing (sail, logo and documentation); woodwork (make the body); and fabrics (make the sail).

While the students worked on the Landcraft project they also worked on a topic in food and health which combined food and information technology. This second project involved basic skills in food preparation, investigation, and design to produce healthy snacks and drinks, a food package and a place-card. Students were also engaged in peer and self evaluation.

Skills Development and Survival Shelter Project

After the Landcraft and Healthy Foods projects it was found that students needed some skill development in the main technology areas, so a program of skills activities was instituted as shown in Table 1.

Table 1: Program of skills activities

Topic	Skills to be Developed
Materials Properties & Testing	using mechatronics equipment to pressure and strength-test materials; impact, heat and water testing
Textiles Properties and Testing	knowing about flammability, strength, wear and tear, absorbency, insulation and stretchability
Textiles	practising hand-sewing, pattern layout, using a sewing machine and overlocker, and finishing
Food	lunch preparation, nutrition and storage
Drawing	orthogonal, isometric and oblique shapes
Information Technology	keyboarding, designing thumbnails and production plans, columns, drop caps, word art, clip art, and using a digital camera

After the skill development program students worked on a project to design and build models of survival shelters. This was a group project involving eight students per group. Each group was given the brief to design and construct a scale model of a shelter, a clothing item, a suitable breakfast and an information brochure. This project was linked to a home-room theme and focused on reflection and group processes.

Developing a Survey

The third module involved a focus on information through the development of a survey instrument. In their development of the survey instrument students considered information sources such as the Internet, how to devise surveys, and methods of data collection; and finally the presentation of survey information on computer. This involved a number of skills, including data tables, graphs, reports, and drawing.

For this module students could also choose to work on a practical activity in either of the Food and Textiles or Materials areas. In the Food and Textiles area the students focused on preparing a morning tea. They considered five situations: Year 2046 futuristic meal; Our heritage morning tea; Digging up the past; Aztec soup; and Egyptian cakes. Participation of parents and community members was sought in these activities. In Textiles the students had to design, make and appraise environmentally friendly bags. They were required to make fabric colour and patterned designs suited to their module. In Materials the students had to design, make and appraise a photo frame. Students completed an investigation focusing on the evaluation of a commercial product, with their report incorporating literacy strategies.

Properties of Materials

In the fourth module the students investigated and evaluated the properties of materials and existing products. This involved checking the finish and quality of garments according to set criteria. Other learning outcomes were to:

- test and modify prototypes ready for mass production (this did not occur due to relocations and other disruptions);
- develop a practical understanding of banking, budgeting, needs and want;
- consider the impacts and consequences of design: social, environmental, functional, aesthetic and ethical;
- work within time and resource limitations and prioritise decisions; and
- consider procedures to mass-produce items (this was only on a superficial level, but at least it started students thinking about the concept).

Students worked in a different practical area in their last module (Figure 1) and made a school currency in materials utilising plastics, used recycled clothing to design and make their own product, and developed a healthy chocolate cake. Students also developed an

information brochure and formally presented their work to the class through an oral presentation.

The last module for the year focussed on students generating ideas about gifts and other related issues. One of these ideas was developed through to a final product incorporating packaging. Students worked within budgetary constraints and produced product costings for the gift.

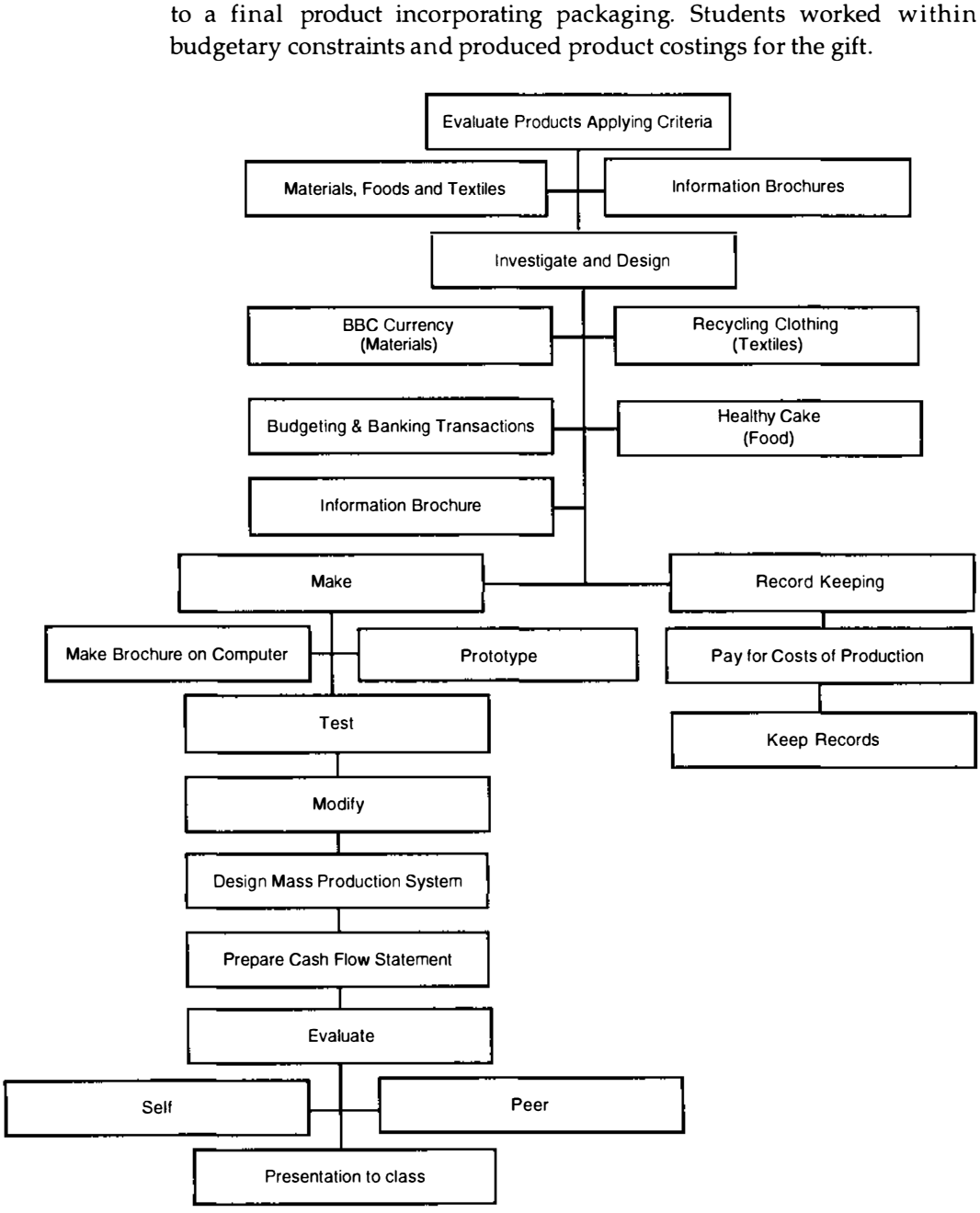


Figure 1: Overview of the fourth module in the program for Years 7-8

Year Nine

Students in year nine were divided into four separate groups where each group formed a different cooperative to simulate a particular workplace environment. The cooperatives focussed on the development of enterprise concepts such as team work, negotiation, problem solving, innovation and creativity through personal and human management.

Product Design

The brief given to students was to design products for young people. This project focussed on: product development; strategic planning (values and mission statements); and marketing and manufacturing of the product designed by the group.

Within the large cooperatives each student was required to complete initial design work on one potential product. The cooperative then had to select four products to develop to prototype. One product had to be developed for each of the four content areas: Food; Textiles; Materials; and Mechatronics. Groups of students (including the originator of the idea) within each cooperative then worked on each product with some student choice permitted in the grouping of students. A guide was developed to help groups ensure they had considered all aspects of the project. There was some concern among staff that the cost of some of the products might be prohibitive.

The project culminated in a product launch attended by school, community, business and education representatives. Each product was displayed at a stall and included all the documentation of the processes involved. At some stalls students took orders for products or permitted sampling or testing of products. Each group made a formal presentation of the product, including a catwalk display, and described what they had set out to achieve. —

Skills and Specialisation

After the large "cooperatives" project the program was organised into two components: focus component; and life skills component. The focus component involved students choosing to work in an area to develop skills or a presentation portfolio by designing and making products. The life skills component involved one hour per week of compulsory skill development, rotated through the information, food, textiles and materials topics.

The third module involved the Year 9 students continuing to specialise in an area of technology in the afternoon while in the hour before lunch

they completed a gift design brief for Christmas. This involved budgeting and production costing, designing a gift from materials, food, textiles, and other (e.g., a Christmas card). They made two of these gifts.

Assessment

The school has a policy of using the Student Outcome Statements (SOS) to assess levels of development. Baseline data were collected at the beginning of the year for all 950 students. Individual modules and projects were assessed across the range of content and process strands. As a result, a student profile for Technology and Enterprise was developed over the year across the process and content strands for each individual student. Pointers were used to target expected behaviours against SOS sub-strands and "Level" statements. All students received this feedback.

Using Pointers

For each project or major activity the technology staff developed a set of pointers for all the process sub-strands and one or more content strands for Levels 1-4. Early in the year the aim was to encourage students to assess themselves in terms of pointers/levels. For example, Year 9 students completed a homework assignment to design a logo for which they completed an outcomes assessment sheet. A teacher then went through the assessment sheet with each student. Teachers were concerned about the standard of work in the logo assignment being very varied and they therefore decided to interview the students. Year 7-8 students also completed an assessment sheet for the landcraft project.

Students in Year 9 had to present their main project proposals to the class. These proposals were assessed on content, involvement of all group members, organised speaking skills, and the model presented. This type of peer and teacher assessment was common practice throughout the year. The main purpose of the outcomes-based assessment was to provide feedback into the learning programs offered to students. For example, it was decided that most Year 7-8 students were weak on investigating and therefore a home-based assignment was given over a three week period to investigate and report on photo-frames, back-packs, and a celebratory meal.

Successes

Over the year the teachers felt they had made considerable progress in developing an inclusive curriculum that allowed students to participate and achieve at different levels. Students were motivated and willing to learn and experience success in their learning

Teachers were able to use a variety of teaching approaches and work collaboratively with other teachers at the school, both within their learning team and across teams. Staff had considerable flexibility in deciding how and what curriculum to deliver, and although having large groups of 180 students at one time presented problems, it enabled greater flexibility. Staff were able to team-teach and develop new skills while being supported by other staff in the classroom.

Difficulties

There were a number of difficulties throughout the year with attempts to implement authentic outcomes-based assessment principles. The main difficulty was that the large number of students made the workload prohibitive in this approach to assessment. It was also difficult to provide holistic assessment, since often the technology staff did not know the individual students. This was compounded by the inability and resistance of some home-room teachers to carry out some of the assessment processes. Many students had difficulty with the wording of pointers. For example, this was very noticeable on the landcraft project.

In general it was difficult for teachers to assess as they taught because they spent all the time helping students, with no time left to reflect. At times it was difficult to determine what to assess. For example, in Year 9 assessment was lacking because there was little student output to assess, and at report time teachers said, "we don't know enough about them". As a result the staff decided to implement assessment in class as a common assessment task over a few sessions. Students were to do it individually with no peer communication. They used an example of a concept from the UK where students were given a design brief to develop a "product for a child to sell at a swap-meet". This involved the following: one session on background information and setting up documents; research at home; two sessions on making the item; and one session to complete the documentation.

It was intended to involve as many teachers as possible in the planning and assessment of technology and enterprise modules. This developed as a major problem throughout the year due to the time and physical constraints of regularly bringing together twenty-five homeroom-based staff and four technology specialists. Some staff felt overwhelmed and unable to adapt to some of the teaching situations they were placed in.

Developing a common understanding of the meaning of the Level statements is fundamental to using them successfully. It was clear that even at a school level this is very difficult to achieve, but between schools and particularly primary and secondary schools it is highly unlikely. The technology teachers at the school had developed a common understanding and consistently applied this to their assessment

strategies. Towards the end of the year they became concerned that they were being too hard in allocating levels to their students. They had consistently allocated mainly Level 1 or 2 to Year 7-8 students. It was clear that a "simple joint" in woodwork is not the same as a "simple joint" with cardboard and glue (e.g., as done in primary schools). Perhaps in woodwork a simple joint is actually a "complex joint". It was suggested to them that they assume that most students had achieved a base level (e.g., 1 or 2) and only look for outcomes beyond that. As a result they decided to write a new report form and be less demanding in assigning levels.

A New Report Format

During August there were a number of school meetings to discuss a new report format. The school wanted to make the reporting the levels much less of a focus. However, there was no general agreement over this. Some felt that there was a need to keep some of the "old stuff" such as grades, because parents understood those better. A problem arose for some subject areas such as mathematics and science where strands are tied to content. Here it was felt that students may be given low levels because the strands had not been covered by that stage of the year. Some teachers wanted to indicate a "normal" level for each year level and compare performance to this by saying was "better" or "worse". The technology teachers had experienced problems with school report sheets, since the levels and High, Medium, or Low grades they had been developing didn't match the reports. Basically they decided that Level 2 meant "Usually done" as indicated on the school reports.

Planning for the Future

The technology staff met a number of times towards the end of the year to consider the program for 1997. There was general concern that during the year the quality of products had been too low due to lack of skills. They were concerned that the school would be judged by poor quality products, and although they didn't want to abandon the design, make, appraise (DMA) approach they wanted to reduce the emphasis on this approach.

Therefore it was decided that for the Year 7 and Year 8 groups the program for 1997 would have students spending the first semester doing "skilling up" work with about five or six weeks on each of the topics Food, Textiles, Materials and Information (including Photography). It was decided to implement this with Year 7 and Year 8 students in the same way, although it was recognised that Year 8 students should know much more than Year 7 students, particularly on using computers. This program would incorporate an introduction to DMA for Year 7 students.

It was also determined that the focus problem for the first semester would be a "Relief Package" project where the students would make a package of food for a relief agency (e.g., Care Australia) to use in drought relief or famine relief. They would make a box to put it in, a parachute to drop it from a plane and some advertising material to raise money to pay for the relief work (including use of photos). DMA would be included in a spiral approach such as using video and guest speakers to research information on relief needs, appraising their food parcels, some design of the parachute and perhaps in the layout of advertising brochures. It was recognised that this might cause problems for teachers involved in the program the following year if they were not involved in this decision making.

In terms of assessment it was recognised that during the year it had been too time-consuming, particularly the method of recording assessment output. It was decided to employ a form used to assess most of the other learning areas with strands/sub-strands listed on the left-hand side and levels listed across the top. The teacher would then indicate with a letter (e.g., C = Computing, M = Materials, etc.) on the chart if an outcome was observed to be demonstrated for a particular activity. There would be one sheet per student, and these sheets would be kept in a class file. It was conceded that it still would be difficult to get home-room teachers involved in assessing and recording.

Conclusions

The four technology-based teachers accomplished a considerable amount throughout the year and achieved many of their initial objectives. They had enthusiastically planned, implemented and evaluated a large number of innovative activities for students in Technology and Enterprise. Most of these activities had been successfully implemented, largely due to the perseverance, collaboration and skill of the four teachers. However, the year had been exhausting and placed an unrealistic workload on them. As a result their concerns about the potential "image" of the program and difficulties with assessment were amplified.

The experience with the program at Ballajura does raise some important issues related to the implementation of outcomes-based programs, the use of the Student Outcome Statements, and the overall direction of the Technology and Enterprise learning area. The focus on outcomes rather than inputs allowed the teachers to offer the students an interesting, relevant and varied program which appeared to meet their needs. This approach ensured that the teachers continually reflected on the program and teaching practices, and that they considered the needs of their students as a major priority in all decisions.

The Student Outcome Statements (SOS) were useful in planning the program but their use in assessment of outcomes were problematic. It became clear that it was difficult to develop a common language and understanding of the outcome statements and to reach a common interpretation. There was often considerable disagreement on the meaning of an outcome and whether a student had demonstrated the outcome. At one stage it became clear to them that even their negotiated meaning was labelling some students with a Level 1 when similar students in other environments would be labelled with a Level 3 or 4. However, using team meetings to making judgements about student work helped to establish these common understandings of the outcomes.

Towards the end of the year the technology staff had concerns about the overall direction of their program, and this was a reflection of the current debate concerning the direction of the Technology and Enterprise learning area. They had enthusiastically supported the move towards an outcomes-based program focussing on design and processes rather than on the development of specific skills and the quality of the finished product. A number of influential people in the local education systems are questioning the degree to which this should be implemented. There is debate about whether there should be more specific skill development to increase the quality of the final product. The staff at the school are concerned that their "high profile" school should not be seen to produce poor quality products if the education systems consider Technology and Enterprise to be a high priority.

It would surely be disappointing if the excellent start to their very relevant and successful program is thwarted by the reactionary views of those who would reinstitute an approach to technology education developed in the 1960s to train factory workers and housewives. Today's students will hardly ever be required to apply the manipulative skills associated with that earlier approach but, rather, will need to develop the conceptual understandings, and the design and management skills required to utilise the powerful technologies of the next century. It is the teachers and the programs developing at schools like Ballajura which will provide students with what they will need from technology education.

CHAPTER FIVE

Introducing Technology and Enterprise in an Isolated Location: Paraburdoo District High School

Anita Phillips and John McQueen

Paraburdoo District High School adopted Technology and Enterprise as a priority in the School Development Plan and decided to introduce it into the secondary curriculum on a whole-school basis by constructing an outdoor eating area at the school. The energy of the staff, administrative support in the school, support from the local community and Hamersley Iron Pty Ltd, an enthusiastic Technology coordinator, and links with students and staff at Edith Cowan University, resulted in an interesting and innovative program which has largely achieved its goals and has maintained the learning area as a priority for the school in the future. Despite the many difficulties and frustrations that are an inevitable part of learning about Technology and Enterprise processes, Paraburdoo DHS hopes that its experience and achievements will encourage others to develop teaching programs in Technology and Enterprise within their own individual schools.

The School

Paraburdoo is an iron ore mining town located in the Central Pilbara region of Western Australia with a population of approximately two thousand five hundred residents. The town is owned and operated by Hamersley Iron Pty Ltd and most of the residents work for the company. The town itself is located on an ancient watercourse and represents a green oasis in an otherwise barren environment that is dominated by the reddish-brown soils of the region and the rugged grandeur of the ranges which yield the iron ore.

The educational needs of the town are met by Paraburdoo District High School which had an enrolment of 439 student across Years K-12 in 1996. As a District High School, the nine students in Years 11 and 12 studied through the School of Isolated and Distance Education in Perth, while all other students were taught by the resident teaching staff which included a principal, as well as a deputy principal (primary) and a

deputy principal (secondary). Primary school enrolments were strong with 59 students in pre-primary and 310 students in Years 1-7. Sixty students were enrolled in the High School in Years 8-10.

The Staff

As a remote and isolated community, the school had a young and enthusiastic teaching staff and effectively functioned as a separate primary and a high school while unified into one administrative, professional and social organisation. The NPDP Technology and Enterprise project was based in the high school section and it is significant that of the six secondary staff members, four were new to the school, and mostly in their first or second year of teaching. Except for the deputy principal, none of the staff had more than five years' teaching experience. One particular concern for the high school section was the inability to obtain the appointment of a specialist Design and Technology teacher and this situation was not appreciated, even by such an industry-based community.

In planning for 1996, the School Development Plan for Paraburdoo DHS had identified three priorities for the High School. These were literacy (Stepping Out), numeracy, and — for the first time — Technology and Enterprise education. The overall aim of the School Development Plan in Technology and Enterprise education was to introduce staff and students to the principles of Technology education by focussing specifically on the process of Designing, Making and Appraising (DMA) and the nature of the Student Outcome Statements. This was a progressive achievement since only one of the staff had any exposure or experience with the process of DMA and none had any real knowledge of the Student Outcome Statements. The goal was to be achieved by ensuring that all high school staff and students would undertake at least one project involving the DMA process during 1996.

The Project

As a result of the professional development day held for all the schools involved in the overall NPDP project and discussion at a subsequent Paraburdoo DHS school staff meeting, it was decided to adopt one whole-school project at the school. This resulted in a decision to develop an outdoor eating area for secondary students and so meet a real need that had existed in the school and had been "talked about" for many years. Staff members were invited to participate with their classes if they felt it fitted in with their teaching programs, although there was no compulsion to do so. With so many new and inexperienced teachers it was important that they were aware of the dangers of "overload" and to take on only what they thought could be reasonably handled.

A full-day professional development seminar was held on a Sunday, late in term one. This was conducted by the tertiary facilitator and was attended by primary and secondary staff, as well as some staff from the neighbouring school at Tom Price. The seminar focussed on the nature of the Technology and Enterprise Learning Area and Student Outcome Statements, with specific reference to teaching and assessment issues, including DMA. Although work on the outdoor eating area project was not planned to begin until term two in order to enable new teachers to settle in to the school, it was interesting to observe the number of staff who almost immediately began to include some individual DMA projects into their teaching programs.

Unlike other schools involved in the NPDP school-based program regular visits by the tertiary facilitator would not be possible, although at least one visit to the school was envisaged. Fortunately, these problems were discussed at the mid-year meeting of schools and facilitators of the NPDP school-based professional development program, and an unexpected source of assistance was offered. Final-year Design and Technology teacher education students at Edith Cowan University were already undertaking a research project, coordinated by Dr John Williams, which linked some of these student teachers in design projects with the University of Newcastle. It was suggested that some of the students not involved with Newcastle would be able to assist the students at Paraburdoo DHS who could communicate their design suggestions and solve their problems by electronic mail and fax communication. Such a joint project was seen as being of considerable benefit to both groups and the offer of assistance was readily accepted.

The outdoor eating area project was to be the catalyst for various teachers and the different subject areas involved in Technology and Enterprise. By adopting a whole-school approach, this project was able to integrate many activities and projects that would be undertaken across the curriculum. The early work is depicted in Figure 1 and Figure 2.

Figure 1: Groundwork for the outdoor eating area commences

Figure 2: The outdoor eating area project continues

Individual projects that were undertaken included:

Year 8 Food Awareness. This class accepted the challenge of designing the components and layout of the eating area. They worked in groups to research existing facilities (including holding a barbecue lunch in 37 degree Celsius heat), drew up various designs, and then constructed scale models of their individual designs. Presentations of the designs and models were made to parents at a parents' and citizens' (P & C) meeting where one design was to be selected for construction. Ultimately the P & C adopted one design, making some modifications to include aspects of other designs that had been presented. This became the final design that was to be constructed.

Year 10 International Food. These students were given the challenge of designing an international herb garden that could produce herbs for their cookery classes. The garden would also be an integral part of the total outdoor eating area and provide an attractive focal point. A birdbath that had been donated was to be included in the design. The students became involved in considerable research about growing herbs and completed scale models of their designs before deciding among themselves which one would be constructed. Following their research, students grew their own herbs from seed, and the school greenhouse soon featured a large selection of herbs that were suitable for planting in early spring.

Year 10 Art. This class was allocated the task of giving the old birdbath a new lease of life. The only design limitation was that the finish had to be weatherproof. As a result of their efforts, the birdbath received a new mosaic finish, ready for inclusion in the herb garden.

Year 9 Science. These students undertook an investigation of vegetation that would be suitable for the outdoor eating area. The class activities were directly related to the Student Outcome Statements by selecting the "Working Scientifically" strand for students to design their own experimentation, complete the procedure and report their results and conclusions.

Year 9 Technology. This class undertook the challenge of the landscaping and paving of the designed outdoor eating area. By focussing on the DMA process the students experienced the frustration of finding acceptable solutions. The students developed a strategy where they would use recycled screens obtained from Hamersley Iron's fines plant. These would be used as pavers, would be easy to lay, and would be available at no cost — a very important criterion. However, after requesting that they be allowed to use the screens, Hamersley Iron wrote to the students explaining that the screens might not be suitable as they

would emit toxic fumes if they caught fire. The issue was referred to the Building Management Authority (BMA) for their decision.

In the other landscaping plans, students were more successful. They visited the local nursery and sought information about the type of plants that would be suitable for the area and then undertook the preparation of the plant beds. Students worked really hard at digging out the area which is no mean feat in the Paraburdoo soil. They improved the soil with compost and mulch that had been provided by the Shire of Paraburdoo and organised and participated in the planting of the eating area. The students also reticulated the garden beds, protecting their plants from the sun with temporary shade cloth covers.

In addition, the Year 9 Technology students were also involved in quite a lot of enterprising activity. They were engaged directly in negotiations with the Shire about obtaining the mulch and had to organise the delivery of soil from Hamersley Iron Pty Ltd.

Year 10 Technology. This class decided to undertake the construction of the outdoor furniture and a basketball area. The students were unsure how they could undertake the actual construction of these items under the guidance of a home economics teacher who, on her own admission, "could just barely remember her Year 8 woodworking skills".

The first Technology project was the development of a basketball "slam dunk" ring. The students at Paraburdoo DHS worked on developing their own design brief which was faxed to the students at Edith Cowan University. This was a great learning experience for the Paraburdoo students as they were usually given a finished brief for them to solve. Actually developing the brief for a project meant that they began to realise how much research might be needed to construct the design brief and to identify critical design factors to be incorporated. It involved activities that included determining how high the average student can "slam dunk" so that the height would be accessible but not too easy. The Edith Cowan University students then worked on a design that met the brief and faxed the design to the students. A number of modifications were made to the design (e.g. strength of bolts) by the Paraburdoo students before construction was actually begun by the University students. The basketball ring was completed and shipped to the school to be installed.

The second project was the design and manufacture of some outdoor furniture for the outdoor eating area. Students researched various examples of outdoor furniture on the market and examined the needs of the student population. One rewarding moment in the project was witnessing the discussion among students at recess and lunchtimes about their seating patterns. In a moment of clear student awareness, the

students discussed how they might need tables and seats that would suit varying sizes of groups "as some kids like hanging around in big groups and some like small groups for talking and stuff."

It was finally decided that they would make two types of seating — one type being long bench-like tables and bench seats, and the other being a smaller type with just four seats around the table. This was eventually changed to an octagon-shaped table since the existing stock of wood that was available in the manual arts room was of different lengths and made a square table impossible to construct. This was another example of the design process in operation where the original design was not working and a substitute idea had to be found. The process of manufacture involved the students at Paraburdoo DHS working on cutting and preparing the wood while the students at Edith Cowan University fabricated the steelwork for the frames for the tables. While only one was constructed, it provided the blueprint for further tables.

Community involvement

Although the outdoor eating area project generated much activity within the school, it also provided the opportunity to involve a number of community groups and businesses. The students and staff were most appreciative of this involvement, for projects such as this would be difficult to undertake without such support. Groups that provided support included the Paraburdoo DHS P & C which was approached at the start of the project as considerable funds were needed to construct an undercover area of this type. Great enthusiasm was shown about the concept — particularly the way in which the students were going to be directly involved in the design and construction of the area. The P & C agreed to assume the organisation and financing of the overhead structure that would be a heat-reflective roof stretching from one wing of the building to another. Due to the restrictions of being constructed in a cyclone zone, the design, engineering, tendering and approval process took over six months with the construction to commence during the Christmas holidays at the end of 1996. Overall, the P & C contributed approximately $7000 to the project, with various fund-raising activities taking place throughout the year.

Hamersley Iron Pty Ltd assisted the project by providing a report on the fines screens and saved the school considerable funds by supplying soil for the site and freight for the metal fabrications from Edith Cowan University. Ashburton Shire Council (Paraburdoo Office) contributed weed matting and mulch for the garden area. The Department of Vocational Education at Edith Cowan University provided the expertise of the academic staff and students as well as sharing the cost of materials used in the fabrication. Students and staff benefited greatly

from the ability to use electronic mail and facsimile communication which reduced the feeling of isolation for the students at Paraburdoo DHS.

Evaluation of the Project

It is interesting to reflect on the problems and successes encountered along the way. The project tended to support the philosophy of the learning area where there are really no failures, only opportunities for improvement. In reality the only significant disappointment for both students and staff was the inability to complete the outdoor area by the end of the year. Expectations in terms of time for the project were unrealistic, since many of the bureaucratic processes were not anticipated.

One continual problem facing Paraburdoo DHS and the finalisation of such a project is the ongoing problem of high staff turnover. Every year the school faces this dilemma, with the need to ensure that new staff receive updates on professional development that had previously been provided at the school. For example, although staff received professional development on Technology and Enterprise and Student Outcome Statements during Term 1, by the end of Term 2 the school had already lost one staff member who had attended the professional development program and was replaced by a new graduate. At the end of the year, three more staff members left and this lack of continuity could seriously reduce the benefits obtained from experiencing the educational process involved in constructing the outdoor eating area.

This particular project contained many facets and one area that was under-estimated was the time necessary to gain approvals through the bureaucratic process. The overhead structure required Shire and BMA approvals that had substantial lead times, and even the tendering process took longer than the staff and students expected. Further unexpected delays occurred because access had to be left for trucks and bobcats to gain access and this held up the construction of the herb garden and the basketball court. Students in particular, did not understand the delays and were extremely frustrated by the occasional lack of activity. Time was also lost due to sports carnivals, work experience and other interruptions and this did have a significant impact upon the amount of work that the students could complete on the project.

There were however major benefits associated with the project. The P & C supported the project enthusiastically and promoted the project widely throughout the community. Parents and other community members seemed very interested in the philosophy and processes behind

the students' work. A public display of the student models at the local shopping centre attracted much positive interest and feedback.

One of the most successful aspects of the project was the amount of contact students made with outside agencies. Students had to focus on developing enterprising skills by contacting, explaining, requesting, and so on; and also learnt to improve their written and oral communication skills. This Enterprise aspect of the project became almost as significant as the design process, with students acquiring other skills including usage of computers, facsimile and electronic mail in a real-life situation.

In terms of staff enthusiasm for the project, the response was very positive. Although not all members of staff took part in the outdoor area project, all staff embraced Technology and Enterprise education in undertaking other projects with their classes. Social studies students produced a cookbook of recipes for cooking with crocodile, emu and kangaroo that the students had designed and tested in Aboriginal studies. Computing and English joined forces to produce an electronic story book for young children.

In addition to the secondary staff taking on Technology and Enterprise education, a number of primary staff, who saw what the secondary teachers were achieving with their students, became curious and sought more information about the learning area. Many projects began to appear including the K-1 class working on a new suit design for Father Christmas as they thought it would be too hot for him in Australia. The teacher involved indicated that she had been enthused by the outdoor garden project, had found out more about DMA and was now "bursting" with more ideas to try out with her classes.

The level of staff support was demonstrated on the last school development day for the year when Technology and Enterprise was again selected as a priority area for the high school. The continuation of the outdoor area project and Technology as a subject has been written into the School Development Plan, funds have been allocated from the school grant, professional development has been planned, and resources have been purchased. It was decided that once the outdoor area project has been completed, another whole-school project will be the focus for entire school participation. Staff members were clearly very supportive of including Technology Education in the curriculum.

Student support was also a feature of the project. Despite the length of the project and intervals of inactivity and delays, the degree of student enthusiasm and ownership over the project clearly demonstrated the value of Technology and Enterprise. The realisation that the plan was going to be carried out, following *their* ideas, using *their* skills, and with only the guidance of staff instead of direction obviously meant a lot to

the students. They gained an understanding of the complexities of the DMA process and were able to reflect on the process and their achievements. They had worked cooperatively and enhanced their self esteem by fully participating in a process that was directly related to fulfilling a need in their everyday environment.

Summary

Overall, Paraburdoo DHS has clearly met its initial very simple goal. All students and staff have become aware of Technology and Enterprise and have an increased understanding of the design process. The school feels that it has done well in the first year of introducing Technology Education into the curriculum and improvements will be made. Staff members have suggested several issues to tackle next time, including the introduction of a journal system for students to reflect upon what they have learnt through the DMA process.

The inclusion of Paraburdoo DHS in the NPDP project was an unexpected bonus which not only inspired the school to attempt a project that was larger than the one envisaged at the time of writing the School Development Plan, but led to the development of extensive networks with a variety of people, schools, agencies and Edith Cowan University. It was very reassuring to know that other schools and teachers were having similar problems and successes when introducing Technology Education into the curriculum. The experience of Paraburdoo DHS is one of optimism and teachers at the school would like to not only thank the many people who have participated so willingly in the project, but to encourage teachers who have not yet taken the initiative to develop programs in Technology and Enterprise. At the least they should utilise the process of DMA — give it a try — for Paraburdoo DHS teachers are confident that the rewards will far outweigh any of the teething problems that are likely to be experienced.

CHAPTER SIX

Technology and Enterprise at St Brigid's College: A First Attempt

Gail Costello and John Williams

At St Brigid's College an attempt was made to utilise the established Year 8 curriculum team to introduce Technology and Enterprise at that level. The goal was to involve all teachers across the various subject areas in conducting a number of technology activities to meet a wide range of goals, which included making both teachers and students aware of the relationships between subject areas. The first activity proved to be successful for both teachers and students. However, when the key school staff directing the project left the school at the end of first semester, the short life of the project meant that insufficient momentum had been generated for it to continue.

The School

St Brigid's College is a K-12 boarding and day school in Lesmurdie, in the hills east of Perth. The K-7 section (525 students) is co-educational, and the high school (648 students) is for girls only. The school was founded by the Sisters of Mercy in 1929 and named after St Brigid of Ireland who, in the fifth Century established a community of nuns committed to serving others. The school promotes a strong spiritual ethos, evident in the planned development of the 'whole person': spiritual, physical, intellectual, emotional and social; and the emphasis on the development of the individual. St Brigid's had no established technology program, and consequently no facilities for teaching technology.

The Teachers

The school decided to devise a technology program at the Year 8 level. A Year 8 curriculum team was first formed in 1996. This team consisted of teachers of Mathematics, Science, English, Social Studies, Computing, Languages, Art, Physical Education, Religious Education, Home Economics and Music. The team identified three main areas on which to focus:

- Security: a sense of belonging and acceptance with peers and the wider school community; confidence with teachers; older students and school structures; developing independent skills but also with the ability to cooperate; willing to have a go; overcome barriers and discover strengths; loyalty and respect.

- Curriculum: opportunities for self expression; relevant; realistic; variety of assessment; encouraging independent and cooperative learning; balance; acknowledging learning styles.

- Induction: orientation and awareness; transition; commitment; life skills and planning; protocol.

From these three areas the curriculum team developed an umbrella theme of *Security and Balance*, with three focus areas in line with school priorities. These were in:

- Independent Learning (knowledge): organisational, problem solving, collaborative skills, team work, technology, positive attitude toward learning;

- Spirituality (faith development): values clarification, community building, respecting others, respecting self; and

- Personal Development (communication): relationship, self confidence, self awareness, protocol, goal setting.

Some of the priorities derived from this analysis by the curriculum team included:

- promote active learning;

- develop a sense of community among Year 8 students;

- minimise the transitional gap between primary and secondary levels;

- present learning in a cross curricular framework; and

- minimise the number of Year 8 teachers.

Project Context and Goals

The technology project was set in the framework developed by the teachers as presented above. Goals for the end of the year were for students to see a relationship between the subjects which would normally be taught in a discrete manner, and to be actively engaged in

their learning; and for teachers to see a wider focus for teaching/learning, and the possibilities for a range of different teaching methods.

Thus the introduction in the school of technology activities was not promoted specifically because of the knowledge and skills derived from the study of technology which might contribute to technological capability, but because it would assist in the achievement of the other identified goals. It was into this context that a range of technology activities was planned. Criteria were developed to guide in the choice of each activity. These included:

- students work in groups;
- the activity to embrace a number of curriculum areas;
- the activity be active;
- the result to be a product or a system;
- a design process be involved; and
- students have control over elements of the activity.

One difficulty in making appropriate choices for the technology activities was the lack of experience and knowledge of the staff involved. Although the Art and Home Economics areas had utilised design projects in the past, their experience with technology was limited, and non existent for other teachers. Another limiting factor was the lack of facilities, tools and resources available for technology activities. This reinforced an essentially limited view of technology. The establishment of criteria assisted in making appropriate choices, as did a guest presentation by the facilitator on the essential components of a good technology activity.

It was seen that the teachers could also benefit from the planned range of activities. The desired outcomes for teachers included:

- Developing confidence in understanding the Student Outcome Statements (SOS) and determining levels at which students enter the secondary learning program.
- Improving understanding of the Technology and Enterprise SOS as a tool for improved curriculum by familiarisation and practical implementation at the Year 8 level as a basis for curriculum planning.

- Creating opportunities to communicate as a team and to gain confidence in professional judgement as more generalist teachers.
- Setting realistic goals for students or modifying goals as a result of student responses.
- Using design briefs as a part of the cross-curricular program over the eight learning areas.
- Utilising journals as a basis for reflection and self evaluation whereby students who are fully aware of the intended outcomes can develop a sense of responsibility.
- Examining reporting and assessment options to develop a more holistic view of assessment.
- Building an awareness of the range of student differences in the Year 8 cohort across the curriculum.
- Developing teacher skills for structured observation of group work, and assessment of student progress as a normal part of active learning and a natural extension of the learning process.

Technology was seen as the vehicle for the achievement of a number of goals. Of concern to teachers was the transition from primary to secondary. This was traumatic for many students, because instead of being a smooth transition which promoted the continued development of students in all areas, for many students it resulted in temporary regression in areas of both academic achievement and personal development. The use of technology activities in Year 8 with a multi-disciplinary and cross-curricular approach was seen as a reflection and continuation of the primary school structure of learning, and therefore could cushion the effect of the dramatic changes faced in secondary education.

The Project and Design Brief

There were timetabling difficulties in finding a block of time to set aside for an extended technology activity. For this reason teachers were not keen on occasional block scheduling, although this was eventually decided upon as the most appropriate mechanism. Organisational suggestions included the establishment of a large board which outlined content for all subjects so teachers could see possible avenues for cooperation, and then work together through that mechanism with small groups of teachers; identify a specific problem or task in which teachers could express an interest and contribute toward the specific design of the task; or teachers interested in cross-curricular work in

technology could indicate their interest, and then come up with a task or activity related to those specific subjects.

It was decided to select a project, and those teachers whose subject areas could contribute to, or were related to the project would then devise a way of setting aside a block of time for the project. The design brief "Marblous Boats" was selected. This brief stated: "From a piece of kitchen foil which is 150 mm x150 mm square, design and make a boat which will carry the largest cargo of marbles for 20 seconds without sinking". Students undertook this activity in home-room teams of four, using four periods which replaced their usual Mathematics and Science lessons and home-room time.

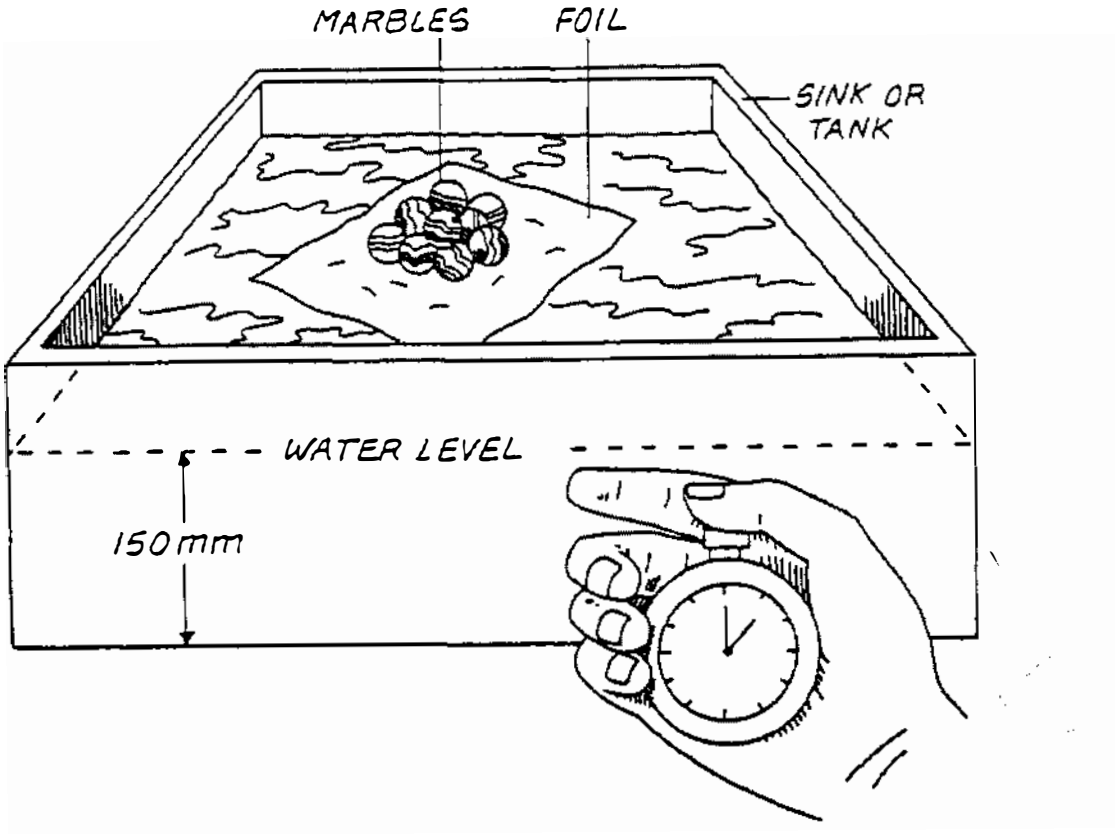


Figure 1: Design brief presented to students

The students were presented with the brief as outlined in Figure 1. In addition, a series of questions was posed for students to answer as a group. Their discussion of the answers was to form the major component of a folio which was to be handed in at the conclusion of the activity. The questions for the group to consider were:

- What happens if you put a flat piece of foil on the surface of the water?
- If you gently push the foil under the water, without trapping the air underneath, what will happen and why?
- If you crumple up the foil in the air and drop it in the water, will it float?
- If you crumple the foil under the water and let it go, will it float? Why?
- If you make your boat out of a 30 g lump of plasticine, how big a cargo of marbles can it carry?
- If you make your boat out of paper, instead of foil, what extra problems does this cause?

Each student was also required to fill out an individual log to form part of the folio, addressing the following questions:

- Write about today's Marblous Boats activity. Did you enjoy it? Why or why not?
- Would you like to have another activity morning like this one? Why or why not?
- If you had to do today's activity again, what would you do differently?

Teachers' Reactions to the Activity

Teachers were generally impressed with how well the students worked in their groups. They tended to drift into their most comfortable roles, with the more adventurous ones doing the designing and testing, and others decorating the folders. This raised the issue of complementary skills within groups, and to what extent the project enabled the development of new skills compared with the reinforcement of existing skills.

However, there were some groups that did not cooperate at all, and became quite argumentative. Teachers realised from this that it was incorrect to assume students possessed the requisite social skills essential for the success of the project, such as the ability to work well in groups and resolve differences and conflict in an acceptable manner.

The activity worked better in groups where the teacher had a good understanding of the activity, and could help students if they were heading off in the wrong direction. Since all the teachers were drawn from a range of disciplines they varied in the level of support that they were willing or able to give to the activity. Quite naturally, after the activity many teachers realised that some aspects should have been covered differently. For example plastic beakers should have been used instead of glass, as the glass ones broke with all the marbles in them; and sometimes there was a shortage of testing stations.

Samples of student work

The student group reports of their activity varied a lot in their presentation. It was obvious that this aspect was very important, with a lot of decorative work going into the presentation of the folders. The content was presented in a variety of ways. Some were very descriptive and requiring several pages of text with no diagrams, while others were mainly graphic with some notation, as in Figure 2.

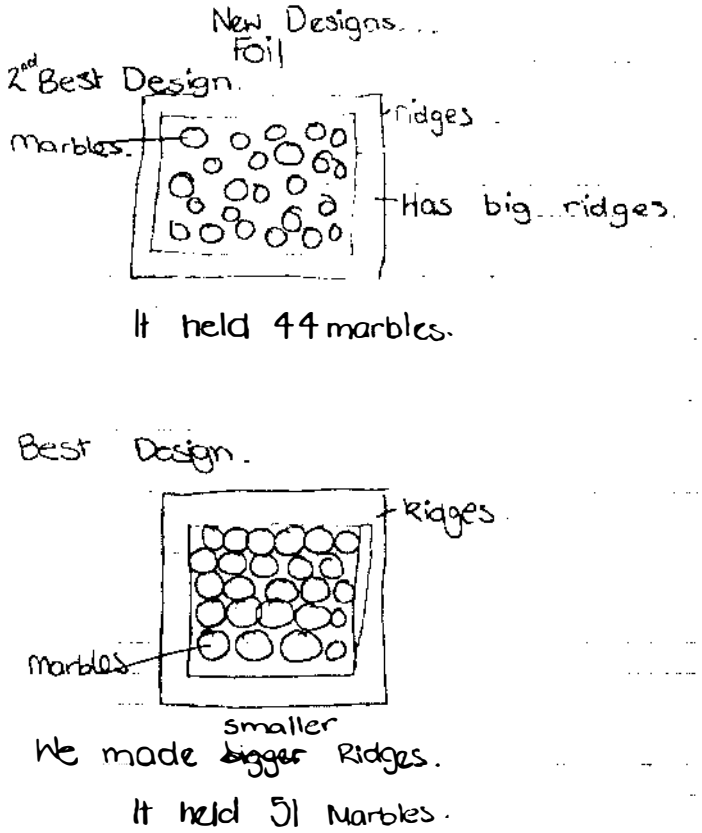


Figure 2: Example of a graphic student report

In general, from three to six attempts were made by the groups using different designs in trying to maximise the number of marbles the boat could hold. For some groups the sequence of attempts indicated a clear development of concepts and progressively more satisfactory solutions. One group presented a sequence of sketches and noted the design changes from one to the next:

- we made the edge higher,
- put more foil on the base,
- wider base,
- littler edges.

Another group decided on a number of variables and then proceeded to test them in an experimental manner as indicated below:

- For our next models we built stronger sides and thinner base and vice versa. The strongest one was the one with stronger sides and a thick base. It floated for 20 seconds with 32 marbles. 32 marbles was the highest amount we succeeded with.

For other groups, there seemed to be no conceptual development related to improving a solution, but more of a hit and miss approach. For example, one group's second, third and fourth attempts are described as follows:

- We folded the edges up again but this time we made them higher. The boat was a square shape. We had 36 marbles in the boat and it stayed afloat for 1.28 minutes.
- Unfortunately this one didn't work. We had deep sides and it was square. We put 44 marbles in and as soon as we put it in the water, it sunk.
- This boat had very tall sides. They were 5 cm tall. It sunk straight away.

Students' Reactions to the Activity

Students were required to complete a log as part of their folio, and this required a response to a number of questions. A summary of these responses is presented in Table 1. It is interesting to note in the last group of responses that the students, after just the one activity, identified some

of the skills critical to doing design work, such as working effectively in a group, following instructions carefully and endeavouring to think creatively. An appropriate next step for teachers would be to offer practice in these areas before attempting another similar project.

Table 1: Percentage Responses to Student Questionnaire

Question	Responses	Response %
Did you enjoy the activity?		
	Yes	89
	No	11
Would you like to do it again?		
	Yes	98
	No	2
Why did you enjoy the activity?		
	It was fun	31
	It involved teamwork	16
	It was different and made a change	13
	It involved my home-room	8
	We got to know each other better	5
	Other/No response	27
Why did you not enjoy the activity?		
	I found it boring	22
	I couldn't agree and didn't cooperate	16
	It was babyish, I did it at primary school	5
	We needed more marbles	5
	Other/No response	52
What would you do differently?		
	Nothing, it was perfect	17
	Mix the home-rooms	14
	Read the instructions more carefully	8
	Cooperate more	6
	Try more design changes	6
	Other/No response	49

Conclusions

As a result of this activity, the following points were noted as worthy of consideration when planning further activities:

- Students enjoy a break from their normal routine, and the opportunity to explore alternative modes of learning.

- Teachers from other learning areas who are to be involved in supervising a design activity should be briefed prior to the task regarding the principles underlying the activity, and the expected outcomes of the activity.

- The parameters of the task should be made clear to students in order to ensure comparability of outcomes.

- Learning in a practical task can be enhanced by preparing students prior to the task in terms of content, principles and methodology; and also by following up to ensure a sound understanding of the principles involved.

At the beginning of this project it was the intention of St Brigid's College to implement a range of technological activities, with the aim of one each term, and extending the numbers of teachers involved from various subject areas. However the one activity reported above was the only activity in technology for 1996. The main reason for this was that the school coordinator for the project moved to another school as did several other key staff members. This highlights the weaknesses inherent in one or two people, rather than a team of committed people becoming the driving force for a project, where the absence of one or two would not jeopardise the whole program. The level of commitment from teachers at St Brigid's at this stage of the project was not enough to ensure the continuation of these types of activities without further guidance at the school level.

CHAPTER SEVEN

Outcomes and Recommendations

Jack Bana and Lorraine Kershaw

This concluding chapter summarises some of the outcomes of the program and recommendations arising from the earlier chapters. These observations may be useful for other schools involved in the design and implementation of Technology and Enterprise programs.

The scope of this professional development program, as described in the previous chapters, was not large in terms of the number of schools involved. It was significant, however, in terms of the knowledge gained, through the eyes of these five schools, about teaching practice in the Technology and Enterprise learning area.

In reviewing their experiences some common features stand out. Initially activities and programs in the five schools were generated by a committed and dedicated school coordinator. Four of the schools continued to rely on the coordinator throughout the year to guide and maintain the program's direction. The fifth school, Ballajura Community College, which already had a substantial program in place , relied upon a team of teachers as well as a coordinator for its impetus.

Some similarities were found in the primary and secondary contexts. Of interest were changes in teachers' attitudes, the factors influencing those changes, the problems faced in meeting the challenges of implementation, and the schools' intentions at the conclusion of the program.

Outcomes

One of the most positive outcomes was seen in the changing attitudes of the students engaged in the activities. They were enthusiastic about their work and prepared to persevere at completing tasks. This was often noticeable with students who had shown disinterest in other areas of the curriculum and a disinclination to persist when problems arose.

The enthusiasm of the students in turn sparked a similar response in teachers. Many who had seemed reluctant to embrace the learning area or had perceived little relevance to the school curriculum gradually changed their attitudes as they observed the positive changes in their

students. In addition, teachers became more aware of the potential for learning through the structure of purposeful activities which had been planned with specific curriculum outcomes. At the conclusion of the program, all five schools were keen to continue what they had begun, even though they would be without the support of an external facilitator or other resources which had been provided by the program.

Schools found students' work in this learning area generated interest with support staff at the school, parents, and the wider community. Some support staff volunteered their expertise and time during various construction phases. Many parents worked with their children in the construction stages when students were required to undertake some tasks at home. Displays of completed models and products were also well attended by parents and educators from other sectors. Some schools had accounts of their endeavours published in local newspapers. Local businesses assisted with materials and advice. This kind of interest from so many groups helped to strengthen the enthusiasm and pride felt by students and teachers, and stimulated teachers' commitment to the learning area.

Communication and cooperation were important to the success of each school's program. Communication across levels, systems and groups, such as primary, secondary and tertiary institutions, professional associations, and differing education systems within the state, took many forms. Seminars and workshops for coordinators and teachers, conference presentations, visits to other schools, and the use of e-mail allowed many other interested educators and groups, as well as the participants, to share experiences and gain knowledge of the learning area. One particular benefit of the involvement of such a diverse group in the program was the wealth of ideas and assistance available when problems arose or changes needed to be made.

While the common outcomes outlined above were both enlightening and rewarding for all those involved in this professional development program, they nevertheless exposed some of the problems affecting successful implementation.

Timetable limitations and "fitting in" technology and enterprise activities to an already demanding curriculum were significant problems. Secondary schools, with their subject area constraints, were more affected than primary schools. When the secondary schools were able to organise their timetable for cross-curricula work, such as at Ballajura Community College and Paraburdoo District High School, timetable problems were considerably lessened. In the case of primary schools, some resorted initially to setting tasks which could be done at home by interested students. As the program progressed, and upon re-assessing the focus and scope of some existing activities, some teachers

were more readily able to adapt these to incorporate technology and enterprise ideas. Even though these strategies alleviated some time problems, however, the coordinators still spent an immense amount of their time, in and out of school, planning, advising and supporting their school staffs.

Lack of resources, such as equipment which cost money the schools did not have, prevented many teachers from embarking upon anything except the simplest of tasks. Primary schools especially lacked many simple carpentry tools, or cooking and sewing equipment. Coordinators, teachers and students became very resourceful in locating useful junk materials and unwanted but workable tools.

This gathering of materials in itself posed a further problem. Schools often did not have available sufficient storage room, space or containers to house all these useful items. Accessibility and portability of materials and equipment were critical where communal work areas were not available and students had to work in their own classrooms. Again this problem was more apparent in primary schools.

The successful achievement of the objectives of this program also depended upon the level of staff involvement and the level of staff knowledge about the learning area. Programs in two of the high schools were particularly affected by staff turnover — in one of the schools the program had to be abandoned, while another had to curtail considerably the scope of its program.

While teachers' initial lack of knowledge of the learning area made implementation difficult, their increased knowledge also proved problematic. Many issues arose for debate when teachers began interpreting skill and task levels. Concern was also expressed about the need for using simple language to derive common understandings for designing activities and assessing achievement levels.

Recommendations

The professional development program implemented in each school found that a vital factor influencing its success was the key role played by the school coordinator. All coordinators were highly motivated, enthusiastic, committed to their job, and had the support of their peers. The strength of the program was enhanced by the support and interest of the principal, key personnel in the school and in the case of one school, by a dedicated team approach. Coordinators also found the support of people outside the school to be useful in maintaining their direction.

As indicated earlier, an impediment to the scope of providing enterprising activities for students was the lack of finance. Schools should consider allocating a technology and enterprise budget, particularly for materials and equipment, and the deployment of a key person in the school. Such a budget could be complemented by accessing support from the local parent and business community.

Not unexpectedly, planned regular professional development sessions for staff were seen as crucial to a successful program. Some sessions for skilling of staff were recommended. It was also suggested that teachers be given assistance in the initial stages with identifying and developing suitable design briefs. Care should be taken, though, to guide teachers in their decision making rather than directing them in their choices. Good design briefs were those which reflected students' experiences or needs. For example, students could design and make products of use to them, or products which could improve aspects of their school environment.

A cross-curricular approach was seen as ideal with planned opportunities for students to engage in collaborative decision making. Where this was not possible and a teacher or school was at the beginning stages of exploring the learning area, to begin small was found to be a successful approach. Only one topic could be chosen by a small group of teachers who could then share their ideas and problems, as well as support and encourage one another.

On a larger scale the development of a school plan was deemed to be beneficial for all teachers. As part of this planning it was suggested that some approaches used in primary schools could be of value in secondary school contexts. Awareness of these approaches could be raised by the strengthening of links between primary and secondary schools.

The written accounts of the five schools in the program provide some insight into how their experienced and inexperienced teachers confronted the demands of exploring and implementing the Technology and Enterprise learning area. These observations and recommendations are presented for others contemplating the challenges of similar programs. They do not pretend to be conclusive judgements — rather they are intended to encourage, and perhaps even inspire.

About the Authors

Jack Bana is Director of MASTEC, the Mathematics, Science and Technology Education Centre at Edith Cowan University, and was Chair of the NPDP Technology and Enterprise Management Committee.

Lorraine Kershaw was the Project Officer for the overall NPDP Technology and Enterprise Project and also for the school-based professional development component reported in this monograph.

Jan Ackroyd was the school coordinator for the professional development component of the Technology and Enterprise program at Safety Bay Primary School.

Gail Costello was the school coordinator for the professional development component of the Technology and Enterprise program at St Brigid's College.

Judith Cousins is a lecturer in early childhood and primary science education at Edith Cowan University.

Helen Lydon was the school coordinator for the professional development component of the Technology and Enterprise program at Ballajura Community College, and was also a member of the NPDP Technology and Enterprise Management Committee.

John McQueen is Coordinator of Vocational Education at Edith Cowan University, and was also a member of the NPDP Technology and Enterprise Management Committee.

Paul Newhouse is a lecturer in computer education and interactive multimedia at Edith Cowan University, and was also a member of the NPDP Technology and Enterprise Management Committee.

Anita Phillips was the school coordinator for the professional development component of the Technology and Enterprise program at Paraburdoo District High School.

Léonie Rennie is associate professor of science and technology education at Curtin University of Technology.

Trudi Summers was the school coordinator for the professional development component of the Technology and Enterprise program at Grovelands Primary School.

John Williams is a lecturer in design and technology education at Edith Cowan University.

MASTEC Monograph Series

Mathematics, Science and Technology Education Centre
Edith Cowan University, Perth, Western Australia